Take Charge!

GENERAL SURGERY AND UROLOGY

A practical guide to patient management

Alexander Trevatt, Richard Boulton and Daren Francis

Series Editor:
Nishanthan Mahesan

CRC Press
Taylor & Francis Group

Take Charge!

Take Charge!
GENERAL SURGERY AND UROLOGY

Taylor & Francis
Taylor & Francis Group
http://taylorandfrancis.com

Take Charge!

GENERAL SURGERY AND UROLOGY

A practical guide to patient management

Edited by

Alexander Trevatt MBChB BSc MRCS
Specialist Registrar
Royal Free London NHS Foundation Trust
London, UK

Richard Boulton BMBS BMedSci MEd FRCS
Consultant General and Colorectal Surgeon
Queens Hospital, Barking, Havering and
Redbridge University Hospitals NHS Trust
Romford, UK

Daren Francis MD FRCS
Consultant General and Colorectal Surgeon
Barnet Hospital, Royal Free London NHS Foundation Trust
London, UK

Series Editor

Nishanthan Mahesan BSc(Hons)
MBBS MRCP(UK) MRCGP
Core Medical Trainee, North East
Thames Foundation School, UK

CRC Press
Taylor & Francis Group
Boca Raton London New York

CRC Press is an imprint of the
Taylor & Francis Group, an **informa** business

CRC Press
Taylor & Francis Group
6000 Broken Sound Parkway NW, Suite 300
Boca Raton, FL 33487-2742

© 2020 by Taylor & Francis Group, LLC
CRC Press is an imprint of Taylor & Francis Group, an Informa business

No claim to original U.S. Government works

Printed on acid-free paper

International Standard Book Number-13: 978-1-4987-8604-1 (Paperback)

This book contains information obtained from authentic and highly regarded sources. While all reasonable efforts have been made to publish reliable data and information, neither the author[s] nor the publisher can accept any legal responsibility or liability for any errors or omissions that may be made. The publishers wish to make clear that any views or opinions expressed in this book by individual editors, authors or contributors are personal to them and do not necessarily reflect the views/opinions of the publishers. The information or guidance contained in this book is intended for use by medical, scientific or health-care professionals and is provided strictly as a supplement to the medical or other professional's own judgement, their knowledge of the patient's medical history, relevant manufacturer's instructions and the appropriate best practice guidelines. Because of the rapid advances in medical science, any information or advice on dosages, procedures or diagnoses should be independently verified. The reader is strongly urged to consult the relevant national drug formulary and the drug companies' and device or material manufacturers' printed instructions, and their websites, before administering or utilizing any of the drugs, devices or materials mentioned in this book. This book does not indicate whether a particular treatment is appropriate or suitable for a particular individual. Ultimately it is the sole responsibility of the medical professional to make his or her own professional judgements, so as to advise and treat patients appropriately. The authors and publishers have also attempted to trace the copyright holders of all material reproduced in this publication and apologize to copyright holders if permission to publish in this form has not been obtained. If any copyright material has not been acknowledged please write and let us know so we may rectify in any future reprint.

Except as permitted under U.S. Copyright Law, no part of this book may be reprinted, reproduced, transmitted, or utilized in any form by any electronic, mechanical, or other means, now known or hereafter invented, including photocopying, microfilming, and recording, or in any information storage or retrieval system, without written permission from the publishers.

For permission to photocopy or use material electronically from this work, please access www.copyright.com (http://www.copyright.com/) or contact the Copyright Clearance Center, Inc. (CCC), 222 Rosewood Drive, Danvers, MA 01923, 978-750-8400. CCC is a not-for-profit organization that provides licenses and registration for a variety of users. For organizations that have been granted a photocopy license by the CCC, a separate system of payment has been arranged.

Trademark Notice: Product or corporate names may be trademarks or registered trademarks, and are used only for identification and explanation without intent to infringe.

Visit the Taylor & Francis Web site at
http://www.taylorandfrancis.com

and the CRC Press Web site at
http://www.crcpress.com

Contents

Preface ix

Abbreviations xi

Contributors xiii

PART I Abdominal Examination

1: Abdominal examination and surgical scars 3
Jason Hol-Ming Wong

2: Stomas 9
Ian Robertson

PART II Gastrointestinal (GI) Tract

3: Lower gastrointestinal bleeding 17
Elizabeth Yang

4: Bowel obstruction 27
Bibek Das

5: Acute diverticulitis 35
Christopher F. Brewer, Alexander Trevatt and Richard Boulton

6: Management of colorectal cancer 41
Oliver J. Smith

7: Perianal disease 49
Prashant Singh

8: Upper gastrointestinal emergencies 61
Suroosh Madanipour

9: Acute appendicitis 73
Amelia Davidson

10: Hernias 79
Jason Hol-Ming Wong

11: Bowel perforation 85
Tom Pampiglione

12: Acute mesenteric ischaemia 95
Urpinder S. Grewal

PART III Abdominal Viscera

13: Gallstone disease 103
Amelia Davidson

14: Acute pancreatitis..... 113
Robert Adams and Christopher Limb

15: Hepatobiliary and pancreatic emergencies 125
Thomas Clifford

16: Endocrine surgery..... 133
Ross M. Warner and Richard Boulton

17: Vascular emergencies..... 147
Stevan Jordan

PART IV Post-Operative Complications

18: Wound infections and dehiscence 163
Deniz Hassan

19: Management of an anastomotic leak..... 171
Ross M. Warner

PART V Trauma

20: Trauma principles 179
Stevan Jordan

21: Burns..... 187
Stevan Jordan

22: Head injuries..... 197
Humza T. Osmani

PART VI Skin

23: Necrotising fasciitis and Fournier's gangrene 213
Alexander Martin

24: Breast lump assessment 219
Jason Hol-Ming Wong

PART VII Urological Disorders

25: Testicular lumps 227
Davoud Khodatars and Sarah Y. W. Tang

26: Genitourinary malignancies..... 235
Davoud Khodatars and Sarah Y. W. Tang

27: Urinary calculus disease 243
Christopher Bastianpillai

28: Catheter management..... 249
Tom Bracewell, Thomas Maggs, David Manson-Bahr, and Sarah Y. W. Tang

29: Benign prostatic hyperplasia 261
Sarah Y. W. Tang

30: Haematuria 267
Christopher Bastianpillai

31: Urinary retention..... 275
Christopher Bastianpillai

32: Testicular torsion 281
Amelia Davidson

33: Obstructive uropathy 287
Rohit Srinivasan

Index 295

Taylor & Francis
Taylor & Francis Group
http://taylorandfrancis.com

Preface

Starting as a Foundation Year 2 Doctor or a core surgical trainee (formerly senior house officer) in general surgery or urology can be a daunting task. Many doctors gain no surgical experience in their first year and surgical exposure at medical school is minimal. Holding the on-call bleep and taking referrals for the first time is stressful, and you will often be asked questions by other specialties that you do not know the answer to. In the vast majority of cases you will also be the first doctor from general surgery or urology to see a patient, and you will be expected by your seniors to produce and act upon a sensible initial management plan.

We have all been there.

Surgical training is as rewarding as it is stressful. You often get more autonomy than other disciplines, but don't always have someone more experienced to immediately turn to for advice. We have written this book, based on our own experiences, to help relieve some of the difficulties you will face on-call.

The common complaints from both general surgery and urology have been included along with their initial management. Whenever you are concerned about a patient you should escalate early to a senior. This book is not a comprehensive overview of the management of each surgical condition, but is instead designed to be a guide to the steps you should take when you first see the patient, in conjunction with escalating to your seniors. Our overall goal is to make you a safer doctor and to give you confidence as you start your surgical career.

Good luck and enjoy!

Taylor & Francis
Taylor & Francis Group
http://taylorandfrancis.com

Abbreviations

AAA	abdominal aortic aneurysm
ABC(DE)	airway, breathing, circulation, (disability, exposure)
ABG	arterial blood gas
ACS	acute coronary syndrome
AIN	anal intraepithelial neoplasia
AKI	acute kidney injury
ALS	advanced life support
ARDS	acute respiratory distress syndrome
AXR	abdominal X-ray
BD	*bis die sumendum* (twice daily)
BP	blood pressure
CCrISP	care of the critically ill surgical patient
CDT	*Clostridium difficile* toxin
CEA	carcinoembryonic antigen
CK	creatinine kinase
CKD	chronic kidney disease
CN	cranial nerve
CO	carbon monoxide
CRP	C-reactive protein
CSF	cerebrospinal fluid
CT CAP	computerised tomography of chest, abdomen and pelvis
CT	computerised tomography
CXR	chest X-ray
DIC	disseminated intravascular coagulopathy
DRE	digital rectal examination
ECG	electrocardiogram
EUA	examination under anaesthesia
FAP	familial adenomatous polyposis syndrome
FBC	full blood count
GCS	Glasgow coma scale
GI	gastrointestinal
GIFTASUP	British Consensus Guidelines on Intravenous Fluid Therapy for Adult Surgical Patients
GP	general practitioner
GTN	glyceryl trinitrate
HIV	human immunodeficiency virus
HNPCC	hereditary non-polyposis colorectal carcinoma (now replaced by Lynch syndrome)
HR	heart rate
I&D	incision and drainage

IBD	inflammatory bowel disease
IV	intravenous
LFT	liver function tests
LIF	left iliac fossa
LMN	lower motor neurone
MC&S	microscopy, culture and sensitivity
MCV	mean corpuscular volume
MDT	multidisciplinary team
Mg	magnesium
MRSA	methicillin-resistant *Staphylococcus aureus*
NaCl	sodium chloride
NAI	non-accidental injury
NOAC	novel oral anticoagulants
O&G	obstetrics and gynaecology
O/P	outpatient
OCP	ova, cyst and parasite
OGD	oesophagogastroscopy
PCA	patient-controlled analgesia
P-POSSUM score	Physiological and Operative Severity Score for the enUmeration of Mortality and Morbidity
PR	per rectal
QDS	*quarter die sumendum* (4 times a day)
RTC	road traffic collision
TB	tuberculosis
TBSA	total body surface area
TDS	*ter die sumendum* (3 times a day)
TNM	tumour, nodes, metastases
TPN	total parental nutrition
U&E	urea and electrolytes
UC	ulcerative colitis
UGI	upper gastrointestinal
UMN	upper motor neurone
UTI	urinary tract infection
VBG	venous blood gas
WCC	white cell count

Contributors

Robert Adams
Specialist Registrar
Royal Free London NHS
Foundation Trust
London, United Kingdom

Christopher Bastianpillai
Specialist Registrar
University Hospitals
Birmingham NHS
Foundation Trust
Birmingham, United Kingdom

Richard Boulton
Specialist Registrar
Royal Free London NHS
Foundation Trust
Romford, United Kingdom

Tom Bracewell
Specialist Registrar
Royal Free London NHS
Foundation Trust
London, United Kingdom

Christopher F. Brewer
Specialist Registrar
Royal Free London NHS
Foundation Trust
London, United Kingdom

Thomas Clifford
Specialist Registrar
Royal Free London NHS
Foundation Trust
London, United Kingdom

Bibek Das
Specialist Registrar
Imperial College London
London, United Kingdom

Amelia Davidson
Specialist Registrar
Royal Berkshire Hospital
Reading, United Kingdom

Urpinder S. Grewal
Specialist Registrar
Medway NHS Trust
Kent, United Kingdom

Deniz Hassan
Specialist Registrar
Whiston Hospital
Merseyside, United Kingdom

Stevan Jordan
Specialist Registrar
Royal Free London NHS
Foundation Trust
London, United Kingdom

Davoud Khodatars
Specialist Registrar
Imperial College NHS Trust
London, United Kingdom

Christopher Limb
Specialist Registrar
Royal Free London NHS
Foundation Trust
London, United Kingdom

Suroosh Madanipour
Specialist Registrar
Royal London Hospital
London, United Kingdom

Thomas Maggs
Specialist Registrar
Royal Free London NHS Foundation Trust
London, United Kingdom

David Manson-Bahr
Specialist Registrar
Royal Free London NHS Foundation Trust
London, United Kingdom

Alexander Martin
Specialist Registrar
Royal Free London NHS Foundation Trust
London, United Kingdom

Humza T. Osmani
Specialist Registrar
Royal Free London NHS Foundation Trust
London, United Kingdom

Tom Pampiglione
Specialist Registrar
Royal Free London NHS Foundation Trust
London, United Kingdom

Ian Robertson
Specialist Registrar
Frimley Park Hospital
London, United Kingdom

Prashant Singh
Specialist Registrar
Royal Free London NHS Foundation Trust
London, United Kingdom

Oliver J. Smith
NIHR Academic Clinical Fellow
Royal Free Hospital
London, United Kingdom

Rohit Srinivasan
Specialist Registrar
Royal Free London NHS Foundation Trust
London, United Kingdom

Sarah Y. W. Tang
Specialist Registrar
Royal Free London NHS Foundation Trust
London, United Kingdom

Alexander Trevatt
Specialist Registrar
Royal Free London NHS Foundation Trust
London, United Kingdom

Ross M. Warner
Specialist Registrar
Northampton General Hospital
Northampton, United Kingdom

Jason Hol-Ming Wong
Specialist Registrar
Royal Free London NHS Foundation Trust
London, United Kingdom

Elizabeth Yang
Specialist Registrar
Royal Free Hospital
London, United Kingdom

Part I

Abdominal Examination

Taylor & Francis
Taylor & Francis Group
http://taylorandfrancis.com

Chapter 1

Abdominal examination and surgical scars

Jason Hol-Ming Wong

A comprehensive abdominal examination is an essential part of diagnosing and managing surgical patients. This chapter will guide you through a complete 'exam style' abdominal examination.

The key points to consider when examining the surgical abdomen are:

- To correlate the clinical findings with the history to make a diagnosis
- To assess whether the patient has an 'acute abdomen'
- To assess the need for surgery and how urgently this is required

Examination

Always: Introduce yourself, explain the procedure, check for pain and ask for permission to examine the patient. Wash your hands and don a pair of gloves if appropriate.

Tip: Keep a stethoscope as your registrar is unlikely to be wearing one and keep a supply of lubricant in your pocket; your time is too valuable to search A&E (accident and emergency) when it is needed.

- Exposure
  - Ask the patient to lie supine
  - Expose the patient adequately in order to examine them appropriately, whilst maintaining dignity

Offer a chaperone where appropriate.

Tip: Document the name of the chaperone present or if one has been declined. For male colleagues it may be appropriate to insist on a chaperone for your own medical legal protection.

- General inspection
  - Look around the bed for clues (i.e. infusions, catheters, drains, etc.)
  - Assess the patient's general condition
    - Glasgow coma scale (GCS) including breakdown if reduced (eyes, voice, motor) – see Chapter 22
    - Breathlessness or obvious discomfort
    - Jaundice or pallor
  - Abdominal distension
  - Any scars/masses/stoma/skin changes
  - *Visible hernias*: Ask the patient to cough/lift head off the bed
- Inspection
  - Hands
    - *Nails*: Koilonychia (iron deficiency)/leuconychia (hypoalbuminaemia)
    - Capillary refill time (normal <2 seconds)
    - Palmar erythema (decompensated liver disease)
    - Finger clubbing (e.g. malignancy, inflammatory bowel disease, suppurative lung disease)
    - Dupuytren's contracture (decompensated liver disease, mechanical)
    - Asterixis (decompensated liver disease, uraemia)
  - Eyes and mouth
    - Jaundice (decompensated liver disease)
    - Pallor (anaemia)
    - Angular stomatitis (iron deficiency)
    - Glossitis (B12 deficiency)
    - Ulceration (e.g. Crohn disease)
  - Neck
    - Virchow's node (left supraclavicular node – GI [gastrointestinal] malignancy)
    - Lymphadenopathy
- Trunk
  - Spider naevi (IVC [inferior vena cava] distribution, >6 – decompensated liver disease)
  - Gynaecomastia (decompensated liver disease, puberty, drug-induced [e.g. spironolactone, digoxin, finasteride, marijuana])
- Palpation
  - Systematically palpate each of the nine segments in a logical sequence, first superficially then deep. Start at the furthest point away from any pain
  - Deep palpation
    - Hepatomegaly
    - Splenomegaly
    - Appendix
    - Bladder distension

    - Percussion tenderness (pain on percussion of abdomen)
    - Rebound tenderness (pain worse on letting go on deep palpation)
    - Guarding (tensing of abdominal wall on palpation)
  - Aortic pulsation (expansile and pulsatile mass)
  - Ballot the kidneys

> **Tip:** If a suprapubic mass is felt, ascertain if you can get below the mass ('arising from the pelvis'). Always perform a pregnancy test if of child-bearing age. Ask about last menstrual period (LMP) in the history.

- Percussion
  - Hepatosplenomegaly
  - Shifting dullness in ascites
  - Bladder
- Auscultate
  - Bowel sound (present, tinkling, absent/scanty) – up to 30 seconds in all four quadrants, best heard in RIF (right iliac fossa)
- Extra examinations for completion
  - External genitalia
  - Examine groin for inguinal and femoral hernias (refer to Chapter 10)
  - Digital rectal examination
  - Urinalysis

Special tests

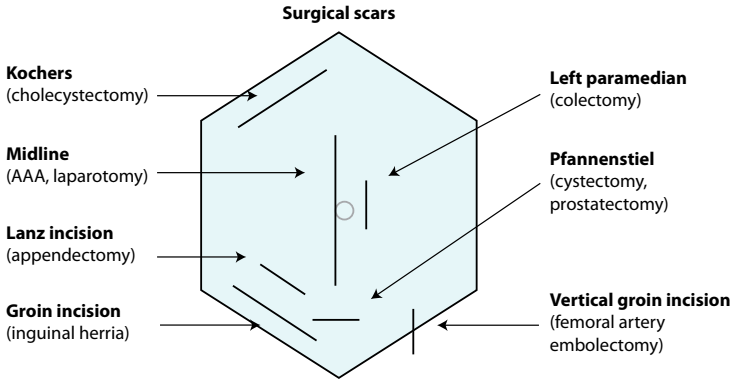
- Rovsing's sign (appendicitis)
  - Palpation of the left lower quadrant produces pain in the right lower quadrant
  - This may point to a diagnosis of appendicitis if the history points to this
- Murphy's sign (cholecystitis)
  - Deep palpation to get underneath the right costal margin in the mid-clavicular line whilst the patient is breathing out
  - Ask patient to breath in and it 'catches' their breath or causes pain
  - This may point to a diagnosis of cholecystitis rather than any other gallbladder pathology, if the same sign is not elicited on the left hand side
- Cullen's sign (acute pancreatitis)
  - Bruising in the subcutaneous fat of the paraumbilical area

- Likely to represent acute pancreatitis due to digested blood tracts from the inflamed pancreas but can also be seen in bleeding from:
  - Blunt abdominal trauma
  - Aortic rupture
  - Ruptured ectopic pregnancy
- Grey Turner's sign (acute pancreatitis)
  - Bruising of the flanks (blue discolouration) is a sign of retroperitoneal bleeding
  - This may point to a diagnosis of acute pancreatitis and may be accompanied by Cullen sign

Common surgical scars

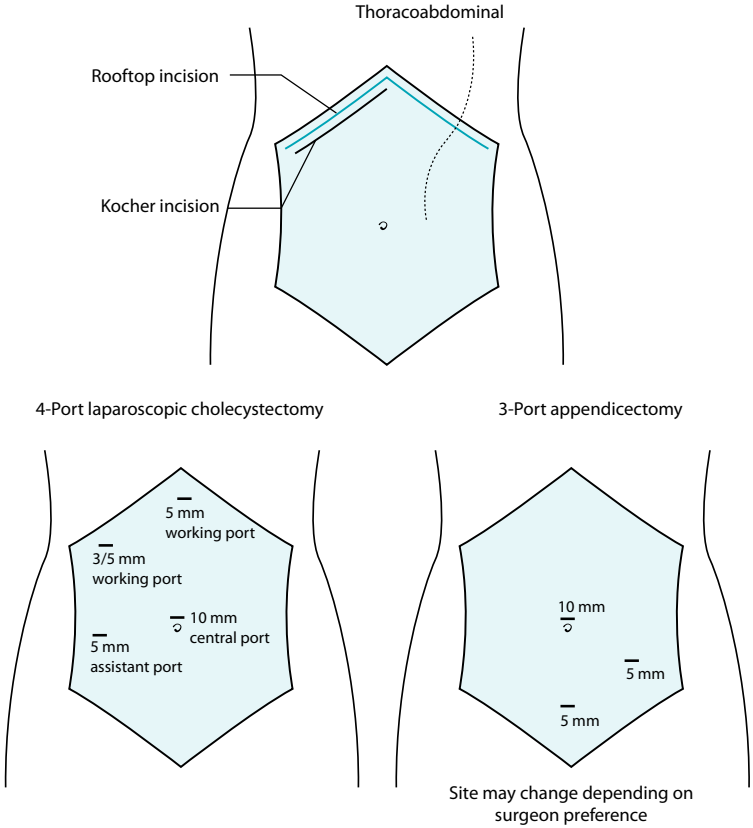
Tip: The trick is to describe what you can see, then attribute the scar to a named incision if appropriate and ALWAYS question the patient about the nature of their scars, particularly if this has not been elicited in the history.

Example image:



1. Kocher
   - Open cholecystectomy
   - Liver or biliary surgery
2. Rooftop
   - Ivor Lewis (two-stage oesophagectomy)
   - Complex pancreatic/liver/gastric surgery
3. Thoraco-abdominal
   - Oesophagogastrectomy

4. Midline
   - Exploratory laparotomy
   - Bowel resection (small and large)
   - AAA (abdominal aortic aneurysm) repair (also performed via transverse incision)
   - *Upper midline*: Massive splenectomy
5. Paramedian
   - Spleen
   - Kidney
   - Adrenal
6. Loin incision
   - Nephrectomy
7. Lanz
   - Appendicectomy
8. McBurney (a.k.a gridiron)
   - Traditional open appendicectomy
9. Groin incision
   - Hernia surgery
10. Rutherford-Morrison
    - Renal transplant
11. Pfannenstiel
    - Pelvic surgery
    - Cystectomy
    - Prostatectomy
    - Gynaecological
      - Caesarian section
      - Hysterectomy
12. Laparoscopic port sites (can also represent drain sites)
    - 5 mm (incision 8 mm)
    - 10 mm (incision 16 mm)
    - 12 mm (incision 19 mm)



Bibliography

McKay D, Blake G. Optimum incision length for port insertion in laparoscopic surgery. *Ann R Coll Surg Engl.* 2006; 88(1): 78.

Chapter 2
Stomas

Ian Robertson

A stoma is a surgically created communication between a hollow viscous and a cutaneous surface. When involving the gastrointestinal (GI) tract they allow faecal output to be diverted to a stoma bag attached to the surface of the abdominal wall. Temporary or permanent stomas can be used by surgeons to manage disruptions in the continuity of the GI tract such as in colonic obstruction, inflammatory bowel disease or GI malignancy.

The key points to consider when assessing stomas are:

- Determining the type of stoma
- Systematically examining a stoma as part of your abdominal examination
- Recognising and managing common complications of stomas

History and examination

The specific details to elicit are:

- When was the stoma created?
- Was this as an emergency or an elective procedure?
- What was the indication?
- Has the stoma changed in any way?
- Is it working? Has the output changed (quantity/consistency)? Presence of blood/mucus?
- Do they have any pain around the stoma site?
- Do they still have a patent/functioning anus? Do they pass anything from their back passage?

As part of a full examination focus on:

- Establishing the type of stoma using the following questions. (Remember an ileostomy is created from small bowel and colostomy from large bowel.)
  - What is in the bag?
    - Liquid stool would suggest a proximal stoma (i.e. ileostomy).
    - Formed stool suggests a more distal stoma (i.e. colostomy).
    - Urine suggests a urostomy, where a short section of small bowel has been disconnected to act as reservoir and bridge the gap between the ureter and the skin. This will likely have a clear bag with a tap or valve in order to empty the urine.

> **Tip:** A colostomy may produce liquid stool if the patient has diarrhoea or a high output stoma.

  - Location of the stoma on the abdomen.
    - Colostomies tend to be found on the left whereas ileostomies are generally on the right.
  - Is the stoma spouted or flush to the skin?
    - Ileostomies and urostomies tend to be spouted, whereas colostomies are generally flat. The spout allows a better seal of the stoma bag, preventing skin excoriation caused by contact with the caustic small bowel or urine content.
  - Is it a loop or end stoma?
    - Look carefully at the stoma to see if there is one lumen (end stoma), or two side-by-side (loop)? A loop stoma is created when both ends of the bowel are brought out to the skin (this allows for easier closure when they are being rejoined in the future).
- Check for the common complications of stomas. They can be divided into immediate, early, and late based on how soon post-operatively they occur.
  - Immediate complications:
    - *Ischaemia/necrosis*: Dusky, cold, purple or black stoma.
    - *Bleeding*: Frank bright red blood in stoma bag from a bleeding mesenteric vessel at the edge of the stoma.
  - Early complications (<3 months):
    - *Retraction*: Internalisation of a spouted stoma.
    - *Prolapse*: Telescoping of the spout of the stoma from the skin opening making it longer than expected.
    - *Mucocutaneous separation*: Separation of the skin from stoma with visible 'gap,' only possible to assess after removing stoma bag.
    - Skin ulceration.
    - *High output (>1500 mL/24 hour)*: Dehydration and electrolyte disturbance.

- Late complications:
  - *Stricture/stenosis*: Bloating, colicky abdominal pain, vomiting and reduced stoma output indicating bowel obstruction – shown to be at the level of the stoma on subsequent imaging.
  - *Parastomal hernia*: A bulge or swelling at the site of the stoma. This can cause obstruction but is usually longstanding.
  - *Intusussception*: Telescoping of the bowel within the stoma into itself resulting in obstruction at the level of the stoma.
  - Psychosexual dysfunction.
  - Nutritional disorders (relate to the resected segments of bowel).

Common stomas

- End colostomy:
  - Single lumen, flush stoma usually located in the left lower quadrant (LLQ). The bag will generally contain semi-formed stool. This is commonly a result of a Hartmann's procedure – resection of a perforated diverticular sigmoid colon and formation of a LLQ end colostomy (the rectal stump is stapled closed and left inside. An anastomosis is not attempted as the risk of leak in a contaminated, infected field is too high).
- End ileostomy:
  - Single lumen, spouted stoma located in the right lower quadrant. The bag will generally contain liquid stool.
- Loop (defunctioning) ileostomy:
  - Double lumen, spouted stoma usually located in the right lower quadrant. It is often used to defunction the bowel, and will generally contain liquid stool.
- Ileal conduit urostomy:
  - Single lumen, spouted stoma with urine content. Ileal conduits are used following cystectomy for urinary diversion. Usually a short section of ileum is anastomosed to the distal ureters and brought out to the skin.

Specific scenarios

A 64-year-old man is returned to the ward having had a defunctioning loop ileostomy and low anterior resection for a rectal cancer that morning. The nurse is concerned because his stoma appears dusky.

A healthy stoma should appear pink to bright red. A dusky stoma is one that appears purple or dark red in colour and is suggestive of ischaemia. It is also cooler to touch. Stomal ischaemia or necrosis most commonly occurs in the immediate post-operative period due to inadequate mobilisation of the bowel or an inadequately sized aperture in the abdominal wall.

- Start resuscitative IV fluids as appropriate.
- Inform your seniors early, the patient may need to return to theatre for further surgery.
- A black necrotic stoma that is cold to touch requires immediate attention.

A patient with an end ileostomy presents with syncope and a stoma output of 2100 mL/24 hour.

Average output from ileostomies ranges between 550 and 1500 mL/24 hour. Ileal effluent is rich in electrolytes, therefore high output stomas can result in electrolyte disturbances and dehydration. A high output stoma is defined as a stoma output >1500 mL/24 hour.

Management of the high output stoma is complex and requires multidisciplinary input. However, you will be required to assess and adequately resuscitate these patients.

- Assess fluid status (examine mucous membranes, skin turgor and symptoms of thirst).
- Calculate fluid balance using stoma and other outputs then record this on a fluid balance chart.
- Check and replace fluid and electrolyte losses, including calcium, magnesium and phosphate levels and consider a blood gas if the potassium is grossly abnormal.
- Request a dietician and stoma specialist review.

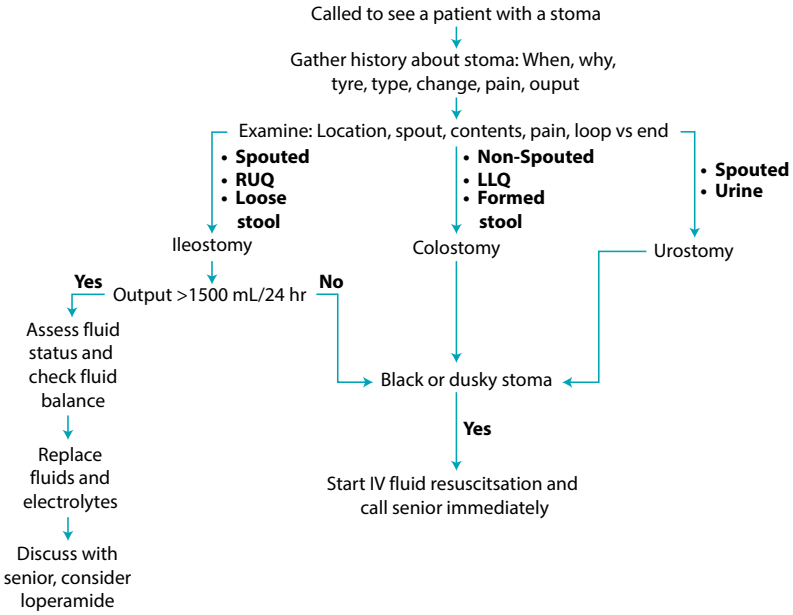
For further management following discussion with seniors consider:

- High dose loperamide (usually started at 2 mg BD [*bis die sumendum* (twice daily)] and titrated to response, up to a maximum of 4 mg QDS [*quarter die sumendum* (4 times a day)]).
  - If stoma output remains high consider adding codeine 60 mg QDS.
- Alteration of diet (i.e. additional salt intake and starchy carbohydrates, reduced fibre content and avoid spices). Do not eat and drink at the same time.
- Oral fluid restriction or specific liquid regimens (e.g. St Mark's solution) may be required as per gastroenterologist's or dietitian's advice.
- Octreotide and/or omeprazole may be beneficial.

- In severe cases supplementary IV fluids or TPN (total parental nutrition) may be required to replace electrolytes and maintain hydration and nutrition.
- In selected cases early reversal of the loop ileostomy may be appropriate.

If in doubt, consider discussing the patient with a stoma nurse. They play a pivotal role in pre-operative planning and post-operative management of stomas. They can be a fantastic source of information if you are unsure!

Summary algorithm



Key questions to ask over the phone when being asked to assess a stoma which will make your time on-call easier:

1. What type of stoma do they have?
2. What was the indication?
3. Where was it performed and which surgeon?
4. What is the output?
5. Have they checked fluid balance/electrolytes and started appropriate resuscitation.

Bibliography

1. Nastro P, Knowles CH, McGrath A, Heyman B, Porrett TRC, Lunniss PJ. Complications of intestinal stomas. *Br J Surg.* 2010;97(12):1885–9.
2. Arumugam PJ, Bevan L, Macdonald L, Watkins AJ, Morgan AR, Beynon J, et al. A prospective audit of stomas – Analysis of risk factors and complications and their management. *Colorectal Dis.* 2003;5(1):49–52.
3. Nugent KP, Daniels P, Stewart B, Patankar R, Johnson CD. Quality of life in stoma patients. *Dis Colon Rectum.* 1999;42(12):1569–74.

Part II

Gastrointestinal (GI) Tract

Taylor & Francis
Taylor & Francis Group
http://taylorandfrancis.com

Chapter 3

Lower gastrointestinal bleeding

Elizabeth Yang

Lower gastrointestinal (GI) bleeding is a very common surgical presentation that can vary widely in severity and aetiology. It is important to initially assess and manage these patients in an ABC(DE) (airway, breathing, circulation, [disability, exposure]) manner. Remember that although benign causes are common, rectal bleeding is a potentially life-threatening situation if the patient becomes decompensated.

The key points to consider when managing a patient with lower GI bleeding are:

- Assessing the patient's volume status and starting resuscitation as appropriate.
- Diagnosing the source/cause of the bleeding.
- Is the patient unstable and require admission or is this an issue that can be managed as an outpatient?

History and examination

The specific details to elicit are:

- Assess the volume of blood loss. Patients are unlikely to be able to tell you exactly but you can get an idea by asking whether it was a spoonful, a cupful, etc.
- Find out the duration and frequency of the bleeding. Was it fresh blood or clots?
- Ask about the colour of the blood (bright red, dark red or black).
- Is there melaena (i.e. black, smelly and sticky stool)? Proximal bleeding usually presents with darker blood but this is not always the case. Large upper GI bleeds with quick transit time can also present with fresh red PR (per rectal) blood, but are usually associated with haemodynamic instability due to large volume blood loss.

- Ask whether the blood is separate from the stool (fissures, haemorrhoids) or streaked on top. Is it mixed with mucus (IBD [inflammatory bowel disease])?
- Is there blood in the toilet bowel or did the patient only notice blood on wiping (haemorrhoids)?
- Is the bleeding associated with pain? Anal fissures are a common cause of lower GI bleeding and can be severely painful during defaecation. Also consider IBD, ischaemic colitis and anal cancers if there is pain or abdominal cramps.
- Does the patient describe tenesmus? (The feeling of incomplete evacuation – highly indicative of a rectal mass.)
- Assess for associated systemic features. If the patient has noticed weight loss or a change in bowel habit then colorectal cancer must be ruled out.
- Ask about personal or family history of malignancy or IBD, obtaining precise details and record of previous treatments where appropriate.
- Iron deficiency anaemia is another sign that may indicate occult malignancy. Ask for symptoms of anaemia such as shortness of breath, lethargy and dizziness on standing.

You should have a list of common and important differentials in your mind as you ask these key questions. An easy way to do this is by examining the anatomical source of bleeding. These have been listed below with the most common causes first.

1. *Anorectal*: Usually presents with fresh PR bleeding (see Chapter 7 for more detail)
   - Haemorrhoids (painless bright red PR bleeding during bowel movement, noted on wiping or in the toilet)
   - Rectal or anal tumour (unexplained weight loss, tenesmus, change in bowel habit, colicky pain, palpable PR mass)
   - Anal fissure (severe burning anal pain associated with defaecation)
2. *Colon*:
   - Diverticular disease (LIF [left iliac fossa] pain, bloating, constipation, fresh rectal bleeding, usually >50 years, associated with low fibre diet. If signs of sepsis and LIF tenderness consider diverticulitis)
   - Infective colitis (severe diarrhoea, cramping abdominal pain – pseudomembranous colitis – caused by *Clostridium difficile*)
   - Inflammatory colitis (ulcerative colitis [UC], Crohn disease) (diarrhoea ± blood or mucus, weight loss, family history, usually affects 15–25 year olds)

- Ischaemic colitis (severe abdominal pain and bleeding, raised lactate, consider if in atrial fibrillation [AF])
- Colorectal cancer (unexplained weight loss, change in bowel habit, fresh or altered bleeding, obstruction)
- Angiodysplasia (rare vascular malformation affecting elderly patients, identified on endoscopy)

3. *Upper GI bleeding*: Usually presents with melaena
   - Peptic ulcer (history of acid reflux/burning epigastric pain after meals, food precipitants)
   - Oesophageal varices (consider in alcoholic liver disease)
   - Mallory–Weiss tear (haematemesis after retching/vomiting)
   - Boerhaave's syndrome (oesophageal rupture after vomiting, severe chest pain, shock)
   - Aorto-enteric fistula (consider after open AAA [abdominal aortic aneurysm] surgery)

Following an ABC(DE) assessment the key parts of the examination to focus on are:

- Assess for haemodynamic stability by checking heart rate (HR) and blood pressure (BP). Look for signs of volume depletion such as pallor, raised capillary refill time, dry mucous membranes and reduced skin turgor.
- Are there signs of jaundice? This increases your index of suspicion of bleeding oesophageal varices as a result of alcoholic liver disease and makes an urgent coagulation screen essential in early patient management.
- Is the abdomen peritonitic? Assess for guarding, rebound and percussion tenderness. Focal peritonism in the LIF suggests diverticulitis, while more diffuse tenderness is common with colitis (particularly ischaemic colitis).
- Are there any palpable masses? Locally advanced tumours can be palpated on abdominal examination and low rectal tumours are easily identified on DRE (digital rectal examination). Hepatomegally suggests significant liver metastases (craggy, irregular outline) or liver disease (smooth outline).
- Assess for lymphadenopathy including Virchow's node.
- Perform a DRE looking for masses or blood. Inspect the anus for anal fissures, skin tags and prolapsed haemorrhoids. Document the findings on DRE clearly in the notes and in the presence of chaperone.

Routine investigations

Routine bloods should be ordered including the following:

- *FBC (full blood count) and CRP (C-reactive protein)*: How low is the patient's Hb? Do they need a blood transfusion? Review the MCV (mean corpuscular volume) – is it a normocytic or microcytic anaemia? Raised WCC (white cell count) or CRP might suggest an infective or inflammatory cause.
- Request haematinics (B12/ folate) and iron studies.
- *Renal function*: Suspect an upper GI bleed if the urea is disproportionately raised in relation to the creatinine. Renal function will also be required if you are ordering a CT scan with contrast. Discuss with on-call radiologist and follow hospital guidance if CT with contrast is required in impaired renal function. Can alternative imaging be performed? Is pre-/post-scan hydration required?
- *Clotting*: In any bleeding patient it is important to check for coagulopathy. Deranged clotting needs to be corrected, especially if the bleeding persists. NB: clotting may not be deranged in patients taking NOACs (novel oral anticoagulants).
- *Group and save*: Necessary if the patient needs a blood transfusion or to go to theatre. Cross match blood if the patient is actively bleeding or unstable.
- *Venous blood gas (VBG)*: Lactate is a useful marker of infection, ischaemia and volume depletion. An initial Hb may also be obtained on VBG.
- Erect chest X-ray
  - To rule out chest infection.
  - To look for air under the diaphragm if you suspect perforation. Note that patients without air under the diaphragm can still have perforation, so use your clinical judgement.
- Abdominal X-ray
  - Should not be ordered routinely unless you suspect bowel obstruction, colitis or toxic megacolon as the cause of bleeding.
- CT abdomen/pelvis
  - Further investigation of cause to screen for abdominal pathology including malignancy.
- ECG (electrocardiogram)
  - Required for anaesthetic purposes before theatre.

Specialist investigations following discussion with seniors

- *Procto-sigmoidoscopy*: This should be performed on all patients with a lower GI bleed. It can be performed at the bedside and can help to identify or exclude bleeding haemorrhoids or a rectal cancer.
- *Colonoscopy*: This is the gold standard investigation for stable patients with lower GI bleeding. Tissue biopsies can be taken to aid in diagnosis and localised bleeding can be controlled with endoscopic techniques such as adrenaline injections, diathermy or clipping. Bowel preparation may be given safely. If the patient cannot tolerate colonoscopy, consider flexible sigmoidoscopy. Colonoscopy can successfully identify the site of severe lower GI bleeding in 80%–90% of patients.
  (See Chapter 5 for the advantages and disadvantages of colonoscopy compared to sigmoidoscopy).
- *Mesenteric angiography*: This can be considered if bleeding obscures the view during colonoscopy or in patients who are actively bleeding and not fit for surgical intervention. It is not usually available in smaller centres and there usually needs to be bleeding of at least 0.5 mL/minute for it to be diagnostic. Mesenteric angiography is especially useful for detecting angiodysplasia and has the advantage of stopping bleeding through arterial embolisation, avoiding the significant morbidity of major surgery.
- *CT angiography*: This can be used as an alternative to mesenteric angiography as it is less invasive, but is purely diagnostic. Active bleeding will require discussion with the on-call interventional radiologist to consider angio-embolisation. With multi-slice CT scanning even small bleeds can be detected and it can also be used to look for other pathology, especially if malignancy is suspected.

Tip: Always consider a large upper GI bleed as a cause of lower GI bleeding and arrange an urgent gastroscopy (OGD [oesophagogastroscopy]) if concerned. An NG (nasogastric) tube can be inserted and aspirated to confirm gastric blood if suspected.

Specific scenarios

A patient with no risk factors presents with a history of rectal bleeding that is bright red and only noticed on wiping. There is no history of weight loss or any change in bowel habit. The patient is haemodynamically stable with normal blood results.

This patient most likely has bleeding haemorrhoids. This can be confirmed with proctoscopy or rigid sigmoidoscopy. This patient would not require hospital admission but should be referred to a colorectal outpatient clinic.

- The patient should be advised to avoid constipation and straining. They should increase their fibre intake and ensure good oral hydration.
- If they are complaining of constipation prescribe oral laxatives or stool softeners.
- Local anaesthetic creams, steroid creams or suppositories may also be beneficial if the haemorrhoids are causing discomfort.

Definitive management will depend on patient and surgeon choice and the nature of the haemorrhoids. It includes:

- Injection sclerotherapy
- Rubber band ligation
- Haemorrhoid artery ligation
- Stapled haemorrhoidopexy
- Open haemorrhoidectomy (for large external haemorrhoids with external component or those not responding to conservative measures)

A 28-year-old male presents with a 5-day history of rectal bleeding associated with diarrhoea. He looks pale and unwell, with a temperature of 38.2°, HR 120, and BP 100/60. He has also complained of cramping abdominal pain and has lost 10 kg over the last 5 months.

This patient most likely has IBD given his age and symptoms.

- Proceed with an ABC assessment. Get senior help early.
- The patient is haemodynamically unstable and requires IV fluid resuscitation through two wide bore cannulas.
- Send bloods to the lab urgently and take a VBG. Also send off blood cultures as the patient remains pyrexial.
- Catheterise the patient and keep a close eye on fluid balance.
- Send three sets of stool samples for (1) ova, cyst and parasite (OCP), (2) *C. difficile* toxin (CDT), and (3) microscopy, culture and sensitivity (MC&S) to exclude infective colitis.

- Request an erect CXR. (look for air under the diaphragm) and AXR (look for colonic dilatation or toxic megacolon).
- Consider CT abdomen/pelvis following discussion with a senior if plain films are not conclusive.
- Consider starting IV antibiotics based on local hospital policy, such as IV co-amoxiclav 1.2 g TDS (*ter die sumendum* [3 times a day]) and IV metronidazole 500 mg TDS, once blood cultures have been sent as part of your local 'surviving sepsis' hospital pathway.
- If the cause remains unclear and patient is peritonitic, arrange an urgent senior review and prepare the patient for surgery.
- Await senior surgical and/or gastroenterology review before considering starting IV hydrocortisone 100 mg QDS.

This patient should be discussed urgently with the medical or gastroenterology registrar as they will likely require high-dose IV hydrocortisone (400 mg/day). In severe cases of colitis that is not remedial to medical treatment, the patient may be considered for an emergency colectomy with the formation of an end ileostomy.

Immediate surgical management may be required if there is toxic dilatation (colon >5.5 cm or caecum >9 cm in diameter) or shock refractory to initial treatment.

If a patient is initially managed medically, a surgical opinion should be sought if stool frequency remains >8/day or CRP > 45, following 3 days of intensive treatment. In cases of UC exacerbation, surgery is likely indicated if there is a poor response despite 10 days of intensive treatment.

During medical management, a patient must be closely monitored for any signs of perforation with a low threshold for performing an AXR and obtaining repeat surgical review if there are concerns.

A 65-year-old female is referred by her GP (general practitioner) for rectal bleeding. She has been complaining of small amounts of blood on the toilet paper over the last few months. She has also been passing more loose stools in the last month and lost about 5 kg of weight unintentionally.

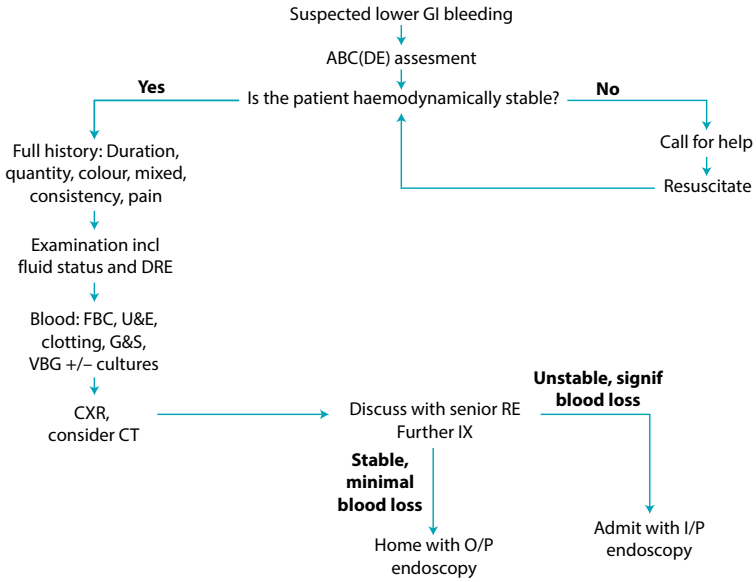
The age and associated weight loss of this patient make malignancy your main differential.

- If she is otherwise well, she can be discharged with an urgent (<2 week wait) referral to see a colorectal surgeon. Check with your senior as they may recommend requesting urgent outpatient investigations prior to clinic review (e.g. CT CAP [computerised tomography of chest, abdomen and pelvis] or colonoscopy).

- If the patient is anaemic, she may require a blood transfusion. This should be discussed with a senior first.
- If she is haemodynamically unstable, she will require admission and appropriate resuscitation.

See Chapter 6 for more information.

Summary algorithm


Suspected lower GI bleeding
ABC(DE) assesment
Is the patient haemodynamically stable?
Yes
No
Call for help
Resuscitate
Full history: Duration, quantity, colour, mixed, consistency, pain
Examination incl fluid status and DRE
Blood: FBC, U&E, clotting, G&S, VBG +/– cultures
CXR, consider CT
Discuss with senior RE Further IX
Unstable, signif blood loss
Stable, minimal blood loss
Home with O/P endoscopy
Admit with I/P endoscopy

Key questions to ask over the phone when being referred a lower GI bleeding case which will make your time on-call easier:

1. Is the patient haemodynamically stable? Request observations.
2. What do they think is the cause of the bleeding and why?
3. What is the volume and nature of the blood?
4. What were the findings on abdominal and PR examination? (Always ensure a PR is done!)
5. What were the blood results? (Request they are performed if not yet done.)
6. Has the patient been cannulated and IV fluids started? Have bloods including group and save been sent?

Lower GI bleeding suspected:

- *Stable patient with minimal blood loss*: Discharge with OP colonoscopy/colorectal follow up.
- *Unstable patient*: Admit for resuscitation and further investigation.
- If in doubt discuss with a senior regarding further management or additional investigations.

Taylor & Francis
Taylor & Francis Group
http://taylorandfrancis.com

Chapter 4
Bowel obstruction

Bibek Das

Bowel obstruction is a commonly received referral when on-call for general surgery. Uncomplicated bowel obstruction is not usually immediately life threatening if it is managed promptly. However, if there is superimposed strangulation, patients can develop bowel ischaemia and become unwell very quickly. This is generally seen when there is a closed-loop obstruction such as in hernias or volvulus. In these cases, obstruction at proximal and distal points causes progressive dilatation of the bowel. Intraluminal pressure rises, which impedes blood flow, resulting in bowel wall ischaemia.

The causes of bowel obstruction can be divided into two categories:

- *Adynamic obstruction* where peristalsis is not functioning properly (e.g. paralytic ileus affecting the small bowel or pseudo-obstruction, where there is acute dilatation of large bowel in an unwell patient with no mechanical obstruction, also known as Ogilvie's syndrome).
- *Dynamic obstruction* where peristalsis is working but there is a mechanical obstruction.

The key points to consider when assessing a patient with bowel obstruction are:

- To assess for any signs of perforation.
- To identify the cause of the obstruction and manage as appropriate.

History and examination

- Ask about abdominal pain. Bowel obstruction usually causes colicky pain. However, if the patient describes sudden onset of severe pain, they may have a perforated bowel and require urgent attention using an ABC(DE) (airway, breathing, circulation, [diability, exposure]) approach.

Table 4.1 Common causes of dynamic intestinal obstruction in adults

Gastric outflow obstruction	Small bowel obstruction	Large bowel obstruction
• Peptic ulcer disease • Malignancy • Pancreatic pseudocyst	Extramural: • Adhesions • Hernias (external or internal) Intramural: • Stricture (Crohnrelated, ischaemic) • Malignancy Intraluminal: • Foreign body (e.g. bezoar) • Gallstone ileus • Intussusception • Faecal impaction • Malignancy	Extramural: • Volvulus Intramural: • Stricture (diverticular, ischaemic) • Malignancy Intraluminal: • Faecal impaction • Malignancy

- Is the abdomen distended? How long has it been like that?
- Find out when they last opened their bowels or passed flatus. Complete obstruction can be distinguished from partial obstruction with the absence of any gas per rectum (or liquid stool).
- Assess the severity of any nausea or vomiting. Ask how many times they have vomited and what the consistency of the vomitus was.
- The higher the level of the obstruction, the earlier that vomiting will be a predominant feature. Gastric outflow obstruction usually presents with projectile non-bilious vomiting, whereas in small bowel obstruction the vomitus is usually bile stained or faeculent.
- Small bowel obstruction tends to present with abdominal pain occurring every few minutes with each wave of peristalsis. In contrast, large bowel obstruction tends to present with pain occurring at a lower frequency and abdominal distension is the more prominent feature.
- Has the patient had haematemesis, melaena or rectal bleeding?
- Is there a history of *Helicobacter pylori?*
- Ask about previous operations (adhesional small bowel obstruction) and abdominal wall or groin lumps that were reducible in the past, but now seem to be irreducible and tender (hernias). The leading cause of small bowel obstruction in patients with previous abdominal surgery is post-operative adhesions (60%).

- In younger patients with no previous abdominal surgery, think about a Crohn stricture, intussusception (e.g. secondary to a polyp in Peutz–Jeghers syndrome) or a congenital band adhesion.
- Large bowel obstruction in adults is most commonly due to carcinoma (approximately 60%) (Table 4.1).
- Ask about systemic features of malignancy (e.g. weight loss, loss of appetite and lethargy) and symptoms such as a recent change in bowel habit, tenesmus or rectal bleeding.
- A diverticular stricture may present a large bowel obstruction, particularly if they have a history of recurrent attacks of diverticulitis.
- Volvulus, where the large bowel (usually sigmoid colon) twists on its mesenteric axis, tends to affect elderly or institutionalised patients with chronic constipation.
- *Assess volume status:* skin turgor, capillary refill, heart rate, blood pressure and urine output. Large volumes of electrolyte-rich fluid can be lost due to poor absorption or in vomitus.
- With strangulation, the abdominal pain will change from a colicky pain to a constant pain of much greater severity.

Tip: Always beware of the patient with bowel obstruction where pain is not relieved by intravenous opiates, as this may suggest bowel ischaemia. Send an urgent VBG (venous blood gas) to review pH and lactate.

As part of a full examination focus on:

- Assessment of the patient's volume status and determine whether they are showing signs of hypovolaemic shock.
- Look for scars from previous abdominal surgery (adhesions or incisional hernias).
- *Strangulated hernias*: Look for a tense, tender lump without an expansile cough impulse; erythema or purplish discolouration are associated with underlying ischaemia.
- Is the patient's abdomen distended?
- Stomas (parastomal hernias or stenosis).
- Is there visible peristalsis?
- Feel for palpable abdominal masses.

- Are there signs of peritonism (indicating ischaemia, infarction or perforation)? In cases of large bowel obstruction, pay particular attention to peritonism in the right iliac fossa as the caecum is most vulnerable to ischaemia in closed-loop obstruction and suggests impending perforation.
- High-pitched 'tinkling' bowel sounds in dynamic bowel obstruction or scanty/absent in adynamic bowel obstruction.
- Perform a digital rectal examination (DRE), palpating for rectal masses, bleeding or strictures.

Routine investigations

Routine bloods should be ordered including:

- *FBC (full blood count) and CRP (C-reactive protein)*: Inflammatory markers (WBC [white blood cells] and CRP) may be raised in bowel ischaemia or perforation.
- *Renal function and electrolytes*: With prolonged vomiting and reduced intestinal absorption of fluids the patient may develop an acute kidney injury and gross electrolyte imbalances may occur. Pseudo-obstruction can be caused by electrolyte depletion, particularly potassium and magnesium. Aim for $K^+ > 4.0$ mmol/L and $Mg^{2+} > 0.7$ mmol/L.
- *Group and screen and clotting*: In case the patient requires surgery.
- *VBG and lactate*: Metabolic acidosis and hyperlactataemia are late signs of bowel ischaemia; metabolic alkalosis is a classic feature of gastric outflow obstruction due to the loss of hydrochloric acid in the vomitus.
- *Erect chest X-ray*
  - To look for air under the diaphragm, but remember, patients without air under the diaphragm may still have a perforated bowel, so use your clinical judgment.
- *Abdominal X-ray*
  - *Small bowel obstruction*: Central dilated loops of bowel with valvulae conniventes. Remember to look for an opacity in the right iliac fossa which would indicate gallstone ileum (see Chapter 13).
  - *Large bowel obstruction*: Peripherally placed dilated loops of bowel with haustra.
  - Sigmoid volvulus has a typical 'coffee bean' appearance.

- Remember the '3, 6, 9' rule, which is a useful reminder of the upper limit of normal (in centimetres) for the diameter of small bowel, large bowel and caecum, respectively.

Specialist investigations following discussion with seniors

- CT abdomen/pelvis (CT AP)
  - If the abdominal radiograph suggests bowel obstruction, a CT AP scan (with IV contrast) should then be performed to confirm the diagnosis and to determine the level of obstruction and cause. This may influence the need for early surgical intervention.
  - Find the 'transition point' where dilated bowel meets collapsed bowel to determine the cause. In small bowel obstruction it is useful to trace back from a collapsed terminal ileum to identify this point. Remember to look for a hernia – a transition point within a hernial sac almost always mandates emergency surgical exploration.

Tip: Do not rely on a CT scan to diagnose ischaemia or strangulation, as this is a clinical diagnosis.

- Gastrografin study
  - A gastrografin enema can be used to differentiate low colonic obstruction from pseudo-obstruction if there is doubt about the diagnosis. This will depend on imaging expertise and preferences at your hospital.
  - Gastrografin follow-through studies can be therapeutic in adhesional small bowel obstruction and confirm when it has resolved.

Specific scenarios

A 52-year-old man presents with colicky abdominal pain and bile-stained vomitus. He has a past medical history of appendicectomy and cholecystectomy. AXR shows central dilated loops of bowel.

This patient has small bowel obstruction, likely due to adhesions. If the patient remains clinically well, they may not require further imaging, particularly if this is a recurrent problem.

- Resuscitate the patient as appropriate with IV fluids. 0.9% saline (with or without potassium) is the most appropriate fluid to correct

hypochloraemia. In other resuscitation scenarios where the patient has not been vomiting or losing fluid from gastric drainage, Hartmann's solution would be more appropriate (for more detailed information visit the following website for the latest GIFTASUP (British consensus guidelines on intravenous fluid therapy for adult surgical patients) guidelines: http://www.bapen.org.uk/pdfs/bapen_pubs/giftasup.pdf).

- Give the patient analgesia (morphine titrated to response) and an antiemetic such as cyclizine or ondansetron.
- Place a large-bore Ryles nasogastric (NG) tube to decompress the gastrointestinal tract. In the initial stages, keep the patient nil-by-mouth (NBM) and leave the NG tube on free drainage with 4-hourly aspiration.

Tip: Metoclopramide is contraindicated in intestinal obstruction as it is a prokinetic.

- Start antibiotics as per local guidelines if there are signs of sepsis.
- Insert a urinary catheter to monitor fluid balance.
- Involve your seniors early in all cases of suspected bowel obstruction.

Adhesional small bowel obstruction will usually resolve with conservative ('drip and suck') management. In patients without features of strangulation, the administration of 50–100 mL of gastrografin (a contrast agent which also acts an osmotic laxative) can be therapeutic. The appearance of contrast in the colon on an abdominal radiograph taken 4–24 hours after administration strongly predicts resolution of small bowel obstruction. Conversely, if contrast is not seen in the colon 24 hours after administration, surgery is required in the majority of patients.

Most surgeons would consider surgery if the obstruction has not settled after 48–72 hours of conservative management. The old surgical aphorism 'the sun should not both rise and set' on a case of unrelieved acute intestinal obstruction was due to the concern that intestinal ischaemia would develop while the patient was waiting for surgery.

A 78-year-old woman presents with abdominal pain and distension. She has not passed flatus in 24 hours. On AXR there is a 'coffee bean' appearance. The patient has a history of recurrent sigmoid volvulus.

- Admit and resuscitate the patient as appropriate. Keep them NBM.
- Involve your senior to review further management.

- Sigmoid volvulus can be managed initially with rigid sigmoidoscopy and passage of a flatus tube. This should only be done by someone with sufficient experience as the blind passage of a flatus tube carries a risk of perforation; if in doubt ask you senior. The flatus can be removed several days later after repeat imaging has shown a resolution of the volvulus. If you are unable to pass a flatus tube, the patient will require flexible sigmoidoscopic decompression.

When endoscopic decompression is unsuccessful, surgery may be indicated and a Hartmann's procedure or sigmoidopexy may be performed. In recurrent sigmoid volvulus where the patient is unfit for a major operation, a percutaneous endoscopic colostomy (PEC) tube may be used to fix the sigmoid colon preventing further rotation and allowing intermittent venting of the large bowel.

A 62-year-old man presents with abdominal distension and pain which started 48 hours ago. He has not passed flatus since the pain started. He feels nauseated but has not vomited. AXR shows dilated loops of large bowel, but no gas in the rectum.

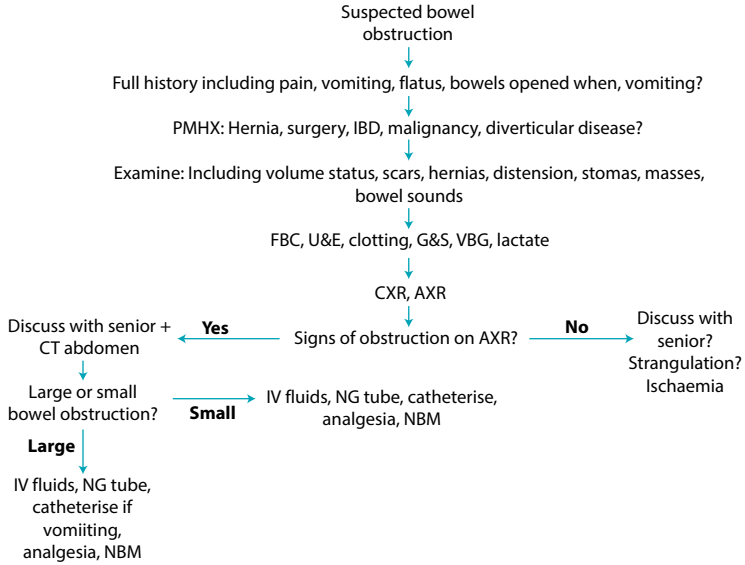
This patient has developed large bowel obstruction. Make sure you have performed a DRE yourself – do not rely on A&E (accident and emergency) to exclude an obstructing rectal cancer.

- Admit and resuscitate the patient as appropriate. Keep them NBM.
- Insert an NG tube, particularly if the patient starts vomiting.
- Insert a urinary catheter to monitor fluid balance. Give analgesia.
- Organise a CT AP (after senior discussion) to identify the cause. A closed-loop obstruction will require early intervention to prevent ischaemic perforation of the caecum.

A complete obstruction secondary to a stricture (benign or malignant) requires surgical intervention with bowel resection ± primary anastomosis ± defunctioning stoma. Stenting may be used as an adjunct to surgery to temporarily relieve the obstruction, but this decision should be made by seniors and based on local expertise. It is usually reserved for patient with metastatic malignant obstruction.

An obstructing rectal cancer should be managed with a defunctioning colostomy in the acute setting to allow staging ± neoadjuvant treatment. Where a safe resection of a colonic malignancy may not be possible (e.g. absence of senior staff and/or advanced tumour), a proximal colostomy is a safe option. In cases of short Crohn-related strictures, a strictureplasty may be possible.

Summary algorithm


Suspected bowel obstruction
Full history including pain, vomiting, flatus, bowels opened when, vomiting?
PMHX: Hernia, surgery, IBD, malignancy, diverticular disease?
Examine: Including volume status, scars, hernias, distension, stomas, masses, bowel sounds
FBC, U&E, clotting, G&S, VBG, lactate
CXR, AXR
Signs of obstruction on AXR?
Yes
No
Discuss with senior + CT abdomen
Discuss with senior? Strangulation? Ischaemia
Large or small bowel obstruction?
Small
IV fluids, NG tube, catheterise, analgesia, NBM
Large
IV fluids, NG tube, catheterise if vomiiting, analgesia, NBM

Key questions to ask over the phone when receiving a referral of a patient with suspected intestinal obstruction:

1. Is there a history of previous abdominal surgery or previous episodes of bowel obstruction?
2. What are the examination findings? Is the patient peritonitic? (However, do not rely on the examination findings of others and ensure you examine the patient yourself. Appreciate that peritonism may evolve with time.)
3. What are the findings from blood tests, VBG and radiographs?
4. Has the patient been cannulated and started on IV fluids?
5. Has an NG tube and urinary catheter been placed?

Chapter 5
Acute diverticulitis

Christopher F. Brewer, Alexander Trevatt and Richard Boulton

Diverticula are small mucosal herniations protruding through the muscle layers of the bowel wall. The incidence of diverticulosis (presence of diverticula) increases with age, from less than 5% before the age of 40 to greater than 65% by 85 years.

Diverticulitis is defined as inflammation of one or more diverticula. It tends to present as left iliac fossa (LIF) pain with signs of infection in patients over 40 years old. Cases of diverticulitis can vary quite considerably in severity and a well-structured history and examination is an important part of assessing severity and starting appropriate management.

The key points to consider in diverticulitis admissions are:

- To assess the severity to determine if the patient requires admission or management in the community with oral antibiotics.
- To recognise complications early and manage them appropriately.
- To resuscitate the patient appropriately and determine the need for surgery.

History and examination

The specific details to elicit are:

- Assess the severity and nature of pain.
- Enquire about associated symptoms of nausea, vomiting, diarrhoea and rectal bleeding. Find out the type of bleeding, how much blood was lost and how long this has been going on for.
- Identify any symptoms of obstruction.

- Many patients (20%–35%) will have recurrent attacks of diverticulitis so it is important to ask if they have had previous episodes, admissions or complications for this condition.
- Prior investigations and results, including endoscopy are useful to know.
- Any constitutional symptoms which might suggest malignancy.
- Does the patient have symptoms of a possible fistula such as offensive, possibly faecal, per-vaginal discharge (colovaginal fistula) or recurrent urinary tract infections, pneumaturia and particulate matter (colovesical fistula)?
- Are there symptoms to suggest sepsis such as fever, or vomiting?
- Previous abdominal surgery.
- Family history of bowel disease.

As part of a full examination focus on:

- Is the patient showing signs of sepsis?
- What is the patient's nutrition and hydration status?
- Does the patient have localised tenderness or is there generalised peritonitis?
- Can you palpate an abdominal mass to suggest abscess formation?
- Is there any blood or a mass on digital rectal examination?

Routine investigations

Routine bloods should be ordered including:

- *FBC (full blood count) and CRP (C-reactive protein)*: If the patient is bleeding, a haemoglobin level will be vital to assess severity of bleeding and guide the need for blood transfusions. WBC (white blood cell) count and CRP will confirm the presence of infection and help assess severity.
- *Renal function*: Will be required if a CT scan with contrast is ordered and electrolyte imbalances can occur with diarrhoea or vomiting.
- *Group and screen with clotting*: If the patient requires surgery, these will be required as part of the pre-operative workup. A deranged clotting result will need to be corrected if the patient has persistent bleeding.
- *Urinalysis*
  - To rule out a urinary tract infection.

- Blood and leucocytes are commonly seen in the urine in intra-abdominal inflammation and a positive urine test may suggest an underlying colovesical fistula.

- *Erect chest X-ray*
  - To rule out a chest infection.
  - To look for air under the diaphragm, but remember, patients without air under the diaphragm may still have a perforated bowel, so use your clinical judgment.

- *Abdominal X-ray*
  - To help rule out obstruction, colitis and constipation.

- *ECG (electrocardiogram)*
  - Will be useful for the anaesthetist when working the patient up for theatre.
  - Will help rule out an acute coronary syndrome (ACS) as a cause of upper abdominal pain.

Specialist investigations following discussion with seniors

- CT abdomen and pelvis (CT AP)
  - Ideally performed with contrast (where kidney function is normal).

- Relative indications:
  - Signs of sepsis with a high degree of suspicion of an abdominal cause.
  - A palpable tender abdominal mass.
  - A peritonitic abdomen in a clinically stable patient (if unstable they may require an immediate diagnostic laparotomy instead or resuscitation followed by imaging. Seek senior input early).

- Endoscopy
  - Not recommended in acute setting. Usually performed at 4–6 weeks post discharge.
  - Evaluates the extent of diverticulosis and rules out malignancy.
  - Either colonoscopy or flexible sigmoidoscopy is performed.

Colonoscopy requires a reasonably mobile patient with good renal function (to be able to tolerate dehydration secondary to bowel preparation). Patients with renal impairment (CKD [chronic kidney disease] stages III-V) either require admission for IV hydration or a flexible sigmoidoscopy (see paragraph relating to flexible sigmoidoscopy).

In patients who would not tolerate colonoscopy, flexible sigmoidoscopy may be used instead.

Advantages of flexible sigmoidoscopy:

- It can usually be performed without sedation.
- It can be performed without bowel preparation and can therefore be used in patients with symptoms of colonic stenosis or obstruction.

Disadvantages of flexible sigmoidoscopy:

- Only assesses the left side of the colon.
- The patient will require a complete colonoscopy if a polyp or other abnormality is found.

Patients undergoing colonoscopy should be advised to drink plenty of fluids and avoid solid food the day before the investigation. They will require a strong laxative beforehand to be taken as either one or two doses, depending on hospital policy. This can be prescribed on discharge to prevent delays. The patient should be warned that while this procedure is considered generally safe, there is a 1:1000 risk of perforation.

Specific scenarios

Where a patient over 40 years of age presents with abdominal pain, mild LIF tenderness, mildly raised inflammatory markers and is otherwise haemodynamically stable:

- Mild cases can be managed in the community with oral antibiotics, analgesia and a low residue or liquid diet until the inflammation subsides.
- A high fibre diet is advised for long-term control.

If this is their first presentation with presumed diverticulitis, an outpatient colonoscopy ± CT AP are useful to confirm the diagnosis and exclude an underlying malignancy or other causes of their symptoms.

Consider your differential diagnosis and ALWAYS discuss with your senior before discharging these patients.

Indications for admission in these patients include failure to tolerate oral fluids, failed conservative management, uncontrolled pain, significant co-morbidities, immunocompromised patients or an uncertain diagnosis.

Where a patient presents with moderate to severe LIF tenderness, peritonitis or systemic signs of infection:

- Start fluid resuscitation and broad spectrum IV antibiotics (as per hospital policy, such as IV co-amoxiclav 1.2 g TDS) before getting early senior involvement.

- Keep nil-by-mouth in case they need to go to theatre.
- Insert a catheter if signs of sepsis or concerns about fluid balance observed.
- Organise an urgent CT AP (after senior discussion), unless they are too unwell to safely transfer to the CT scanner in which case they will need to be stabilised first. Involve your senior immediately in any unstable acute surgical patient.

Further management will be dependent on the results of the CT scan:

Contained perforations or abscesses may be amenable to percutaneous drainage and are unlikely to require surgical intervention. They should be discussed with an interventional radiologist.

If there are clinical or radiological signs of generalised peritonitis, the patient will likely require surgery. Local surgical expertise will determine the type of surgery performed, but patients with purulent peritonitis will generally go for diagnostic laparoscopy and washout ± drain ± proceed.

Those with faeculent peritonitis require a laparotomy and a Hartmann's procedure (removal of the affected segment of sigmoid colon and formation of an end colostomy). These patients are likely to be septic and may require admission to ITU (intensive treatment unit) for organ support or inotropes, if they remain hypotensive despite fluid resuscitation. Early referral and involvement of the intensivist are advised in these patients.

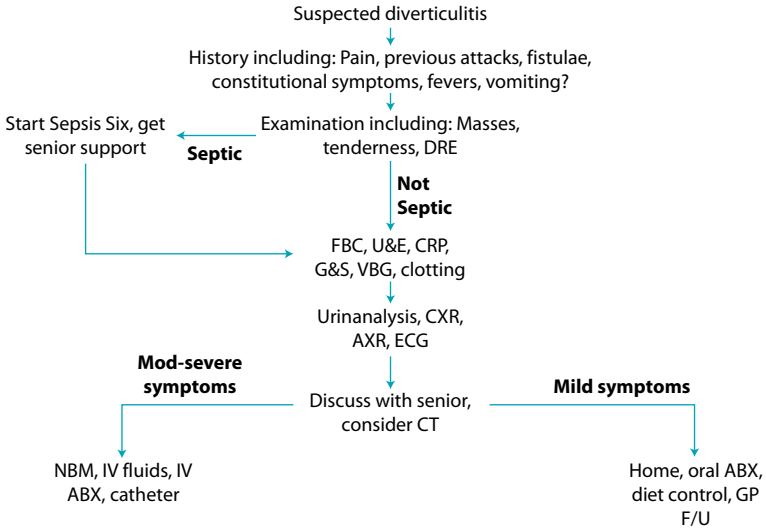
Natural sequelae

Many patients with diverticulitis will see a complete resolution of their symptoms with antibiotics alone, however, some will go on to develop complications such as:

- Abscess formation
- Perforation and generalised peritonitis
- Rectal bleeding
- Fistula formation
- Recurrent infections leading to chronic scarring and stenosis

You should remain vigilant for these complications and regularly review your patients with more concerning signs and symptoms.

Summary algorithm


Suspected diverticulitis
History including: Pain, previous attacks, fistulae, constitutional symptoms, fevers, vomiting?
Examination including: Masses, tenderness, DRE
Septic
Start Sepsis Six, get senior support
Not Septic
FBC, U&E, CRP, G&S, VBG, clotting
Urinanalysis, CXR, AXR, ECG
Discuss with senior, consider CT
Mod-severe symptoms
NBM, IV fluids, IV ABX, catheter
Mild symptoms
Home, oral ABX, diet control, GP F/U

Key questions to ask over the phone when being referred a diverticulitis case which will make your time on-call easier:

1. Is the patient known to have diverticular disease?
2. Have other differential diagnoses been ruled out? Request CXR and urinalysis.
3. What were the findings on abdominal examination?
4. What were the blood results? (Request they be performed if not yet done.)
5. Has the patient been cannulated and IV fluids/antibiotics started?
6. Is the patient exhibiting signs of sepsis?

Chapter 6

Management of colorectal cancer

Oliver J. Smith

Colorectal cancer is the third most common cancer in the UK and the second most common cause of cancer death with approximately 40,000 new cases per year. Peak incidence is in the sixth decade with the risk of disease strongly linked to age, although diagnoses in younger patients do occur. It is associated with increasing age, family history, diet rich in fat and meat with low-fibre content ('Western Diet'), IBD (inflammatory bowel disease) and diabetes. Colorectal cancer follows a classical sequence of polyp–adenoma–carcinoma and is therefore a target for at-risk population screening to identify and treat pre-malignant lesions.

Presentation of colorectal cancer can vary greatly and will depend on several factors:

1. Location of tumour
2. Size of tumour
3. Local complications (e.g. fistulas, stricture formation, obstruction, perforation and bleeding)
4. Local or distant metastatic spread

The onset of colorectal cancer is usually insidious. You will rarely make a new diagnosis of the disease when on-call unless any of the complicating features are present (usually at an advanced stage) or an incidental abnormality is identified on imaging.

The key points to consider when referred patients with suspected colorectal cancer are:

- Identifying the 'red flag' symptoms or reason why the referrer suspects the diagnosis.
- Assessing for acute life-threatening complications of colorectal cancer such as obstruction, perforation or significant bleeding.

Ensuring appropriate outpatient target investigations are arranged (e.g. colonoscopy ± CT chest/abdomen/pelvis) and the patient is urgently followed up (<2-week wait) with a colorectal surgeon.

Red flags

- Weight loss
- Altered blood PR
- Change in bowel habit (>6 weeks if >50 years of age)
- Palpable rectal mass
- Iron deficiency anaemia (men any age, non-menstruating women)

History and examination

The specific details to elicit are:

- Has the patient had any unplanned weight loss? How much and over what timeframe?
- Have they noticed any blood in their stool – right-sided tumours tend to have darker stools, altered blood or normal appearance (occult blood loss). In left-sided tumours blood will be mixed with the stool and rectal tumours may present with bright red blood.
- Abdominal pain or tenesmus (sensation of incomplete bowel emptying).
- Symptoms of iron deficiency anaemia – tiredness, palpitations, dizziness.
- Change in bowel habit.
- Is the patient exhibiting signs of obstruction (vomiting, distension, constipation, pain)?
- Signs of perforation.
- Presence of a fistula.
- *Risk factors to ask about*: Family history, personal history, IBD, acromegaly, familial diseases (e.g. FAP [familial adenomatous polyposis syndrome], Lynch syndrome formally known as HNPCC [hereditary non-polyposis colorectal carcinoma (formally known as Lynch syndrome)], Gardner's), diet (e.g. red meat, high fat, low fibre), previous colonic polyps.
- Any previous endoscopies, when/where they were performed and their results.

As part of a full examination focus on:

- Does the patient have any signs of chronic disease such as cachexia, anaemia (pallor, pale mucous membranes), jaundice or clubbing?
- Feel for lymphadenopathy, particularly the left supraclavicular (Virchow's) node.
- Any palpable masses or organomegaly?
- Does the patient have abdominal pain or tenderness? If they are guarding or showing signs of peritonitis urgent discussion with a senior is required.
- Is the abdomen distended? Are they obstructed or do they have ascites?
- Perform a digital rectal exam, palpating for masses, blood, mucus or fistulous opening.

Routine investigations

Routine bloods should be ordered including:

- *FBC (full blood count)*: If anaemia present then add haematinics and iron studies to assess for iron deficiency.
- *Group and save*: A transfusion may be required if the anaemia is significant or the patient requires an operation.
- *Renal function*: The patient will likely require a staging CT (computerised tomography) scan with contrast.
- *LFTs (liver function tests)*: These will help assess for liver metastases.
- *CEA (Carcinoembryonic antigen)*: This is the main tumour marker in colorectal cancer and will be helpful to monitor response to treatment, but should only be ordered after discussion with seniors.
- *Abdominal X-ray*
  - This should be ordered if you suspect a complication such as bowel obstruction.
- *ECG (electrocardiogram)*
  - If the patient requires surgery this will be required as part of the pre-op assessment.

Specialist investigations following discussion with seniors

- Colonoscopy
  - This is the 'gold standard' investigation for colorectal cancer and is recommended by NICE (National Institute for Health and Care Excellence) as a first line investigation. It can be performed as outpatient (<2-week wait) and allows direct visualisation and tissue biopsy.
  - Alternatives to colonoscopy include:
    - *Flexible sigmoidoscopy*: Can be offered to patients with major co-morbidities and who are unable to tolerate bowel prep. Advantages include being a simpler and less invasive procedure, however, it only visualises the left side of the bowel and will miss more proximal lesions.
    - *CT colonography*: Offered to patients with major co-morbidities or who are unable to tolerate a colonoscopy. It still requires the patient to take bowel prep (although a reduced faecal tagging protocol can be used in high-risk individuals). Advantages include being a less invasive technique and no sedation is required, however, it doesn't allow direct visualisation or tissue biopsy.
    - *Double contrast barium enema*: Useful to assess location of an obstruction in patients who can't undergo CT. However, it is dependent on local radiology expertise and therefore rarely performed in the UK in the advent of CT.
- CT CAP (computerised tomography of chest, abdomen and pelvis)
  - This will be needed for staging of the cancer, to help plan long-term management.
  - It may also be used acutely to assess for obstruction or perforation.
- MRI pelvis
  - This is reserved for patients with rectal cancer to allow more accurate staging and assess the resection margin or response to neoadjuvant treatment.

Following these investigations, staging of colorectal cancer can be performed using two systems. For reference these are:

TNM (tumour, nodes, metastases) staging (most commonly used now)

- T: Related to size and degree of local invasion.
  - T1 = invades submucosa; T2 = invades muscular propria; T3 = invades serosa; T4 = invasion of surrounding structures.
- N: Related to degree of nodal spread.
  - N1 = 1–3 LN (lymph nodes); N2 = 4 or more LN.
- M1: Presence of distant metastases.

The Dukes classification system (less commonly used):

- *Dukes A*: Confined to mucosa or submucosa.
- *Dukes B*: Invading through bowel muscle wall.
- *Dukes C*: Spread to regional lymph nodes.
- *Dukes D*: Distant metastases.

The patient should be referred to the lower GI MDT (multidisciplinary team) for discussion of further management.

Specific scenarios

A 69-year-old man presented with a 9-month history of weight loss and change in bowel habit. He is otherwise well.

This presentation is suspicious of colorectal cancer and the appropriate investigations must be ordered. Provided he is otherwise well, these investigations can be performed as an outpatient (<2-week wait target referral).

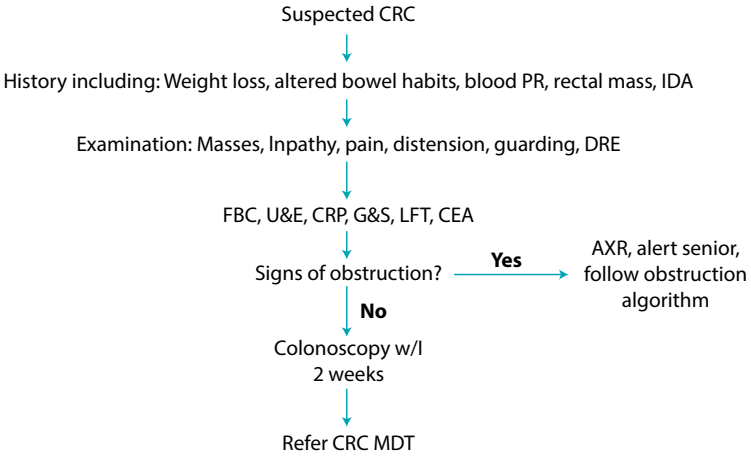
- Assess for any signs of obstruction, perforation or peritonitis. If these are found the patient will require immediate ABC(DE) (airway, breathing, circulation, [disability, exposure]) resuscitation with IV fluids, etc. and early senior input.
- Organise an urgent outpatient colonoscopy and colorectal follow up. If malignancy is confirmed, a staging CT CAP will be performed.
- The results of the investigations should be discussed at the next colorectal MDT.
- If a patient is anaemic ensure a full anaemia screen is done (FBC, iron studies, B12, folate, thyroid function tests, OGD [oesophagogastroscopy]).
- Indications for admission in these patients include: obstruction, perforation, severe abdominal pain, symptomatic anaemia, severe PR bleeding, unable to tolerate oral fluids. Fistulation and cachexia may also warrant admission following discussion with your senior.

Patients with operable tumours will be considered for surgery following discussion at the MDT. The type of management will depend on the size, site and degree of spread of the tumour. Options include:

- *Left hemicolectomy*: For left-sided tumours.
- *Right hemicolectomy*: For right-sided tumours.

- *Anterior resection (resection of upper two-thirds of rectum leaving rectal sphincter intact and can be extended to lower sigmoid)*: For rectal tumours.
- *Abdominoperineal resection (resection of anus, rectum and lower sigmoid with permanent colostomy)*: For low rectal tumours.
- *Hartmann's procedure*: For acutely obstructing sigmoid tumours or in situations where the risk of anastomotic leak is deemed too great. This involves resection of sigmoid colon with the formation of an end colostomy and oversewing of the rectal stump. The colostomy may be reversed and anastomosed several months later.
- *Radiotherapy*: This is used in locally advanced rectal cancer with or without chemotherapy as neoadjuvant treatment to reduce the tumour size and risk of local recurrence. It is avoided in colon cancer due to the risk of inadvertent small bowel injury.
- *Chemotherapy*: This is more commonly used in advanced disease with metastases or combined with radiotherapy in rectal cancer.
- *Palliative treatment*: Where curative surgery is not possible, endoscopic stenting can be used to place a stent across the obstructing lesion and relieve symptoms. Resection or bypass of obstruction can also be undertaken.

Summary algorithm


Suspected CRC
History including: Weight loss, altered bowel habits, blood PR, rectal mass, IDA
Examination: Masses, lnpathy, pain, distension, guarding, DRE
FBC, U&E, CRP, G&S, LFT, CEA
Signs of obstruction?
Yes
AXR, alert senior, follow obstruction algorithm
No
Colonoscopy w/l 2 weeks
Refer CRC MDT

Key questions to ask over the phone when being referred a potential colorectal cancer case which will make your time on-call easier:

1. Does the patient have signs of obstruction or perforation?
2. Are they well enough to be managed as an outpatient?
3. Are there red flags in the history? (e.g. weight loss, cachexia, change in bowel habit, PR bleeding, tenesmus, strong family history, risk factors, signs of bowel obstruction [distension, constipation, abdominal pain, vomiting], progressive history)
4. Are there suspicious findings on the abdominal or rectal exam?
5. Is there iron deficiency anaemia on the blood tests?
6. Will they tolerate colonoscopy? Co-morbidities?

Taylor & Francis
Taylor & Francis Group
http://taylorandfrancis.com

Chapter 7
Perianal disease

Prashant Singh

Perianal disease, or anorectal pathology, includes perianal abscesses, haemorrhoids, anal fissures, fistulae, anal or rectal cancers and prolapse. Abscesses and haemorrhoids are frequently encountered whilst on-call and are covered in the most detail in this chapter. The underlying principles of management involve establishing an accurate diagnosis promptly, recognising which patients require urgent operations and choosing the correct operation where necessary.

Perianal abscess

A perianal abscess is a collection of pus in the perianal tissue, usually as a result of infection of the crypts of Morgagni. Without incision and drainage (I&D), a perianal abscess will become larger and more painful, eventually leading to necrosis and/or sepsis (including necrotising fasciitis). It is a frequently encountered presentation and predominantly occurs in adult males. One-third of these patients will have an underlying associated fistula which can cause recurrent infections if not recognised and treated.

History and examination

The specific details to elicit are:

- The duration of symptoms.
- Previous episodes of abscess or fistula, their location and any interventions that took place.
- Has the patient been started on any antibiotics?
- Systemic features of sepsis, e.g. fever, malaise, vomiting, anorexia.
- Symptoms of underlying inflammatory bowel disease.

- Potential immunosuppression (e.g. steroids, diabetes, HIV [human immunodeficiency virus], other immunosuppressive medication: methotrexate, MMF [mycophenolate mofetil], cyclosporin).
- Clinical features of underlying malignancy.
- Symptoms or a past medical history of a fistula (purulent or foul-smelling discharge).

As part of a full examination focus on:

- *Look for any external pathology*: Fissures, scars, thrombosed piles which may suggest an alternative diagnosis.
- Is there is an abscess/area of fluctuancy in the perianal or rectal region? Perform a DRE (digital rectal examination). If present, what is the location? (Describe using a clock face, with genitalia at 12 o'clock in lithotomy position.) Differentiate perianal abscess from cutaneous buttock abscess and pilonidal abscess. If the patient has an acute anal fissure they may not be able to tolerate rectal examination.
- Are there overlying skin changes or induration? Cellulitis? Necrosis?
- Note that an ischiorectal abscess may present with only a small perianal swelling. An ischiorectal abscess is a specific type of perianal abscess where pus forms between the rectum and pelvic bone (ischiorectal space). This can be a large, deep cavity with minimal external signs other than sepsis.
- An intersphincteric abscess may not be detectable on examination due to pain on DRE.
- In cases where a patient has perianal pain and fever/raised inflammatory markers, an examination under anaesthesia (EUA) is necessary for diagnosis and treatment. Keep the patient nil-by-mouth, start IV (intravenous) antibiotics as per hospital policy, and arrange early senior review.

Routine investigations

Some common benign pathology may only require an examination, diagnosis and explanation with outpatient treatment, but this comes with experience. If in doubt, routine blood tests and pre-operative workup is the safest approach combined with senior review.

Routine bloods should be ordered, including:

- *FBC (full blood count) and CRP (C-reactive protein)*: For diagnosing suspected infection and classifying severity or monitoring response to treatment. Significant anaemia may require a transfusion or repeat testing.

- *Renal function*: Necessary if the patient requires a CT (computerised tomography) scan.
- *Blood cultures*: Perform if septic before giving IV antibiotics (according to local protocol, such as co-amoxiclav 1.2 g IV TDS).
- *Group and screen with clotting*: Part of pre-operative workup. Deranged clotting may need to be corrected prior to surgery depending on the derangement.
- *ECG (electrocardiogram)*
  - As part of pre-operative workup in anyone over 40 years of age, or if there is suspicion of cardiac disease. Liaise with the anaesthetist to determine whether one is needed if in doubt.

Specialist investigations following discussion with seniors

- In non-recurrent disease where the diagnosis is clear, imaging is not generally indicated.
- MRI
  - MRI may be indicated when the diagnosis is unclear, or in patients with recurrent perianal sepsis, to diagnose and delineate potential fistulous tract(s). This should be performed pre-operatively as it may become difficult to assess radiologically once the patient has had a procedure or intervention.
- Endoanal ultrasound
  - This is a specialist investigation occasionally performed by a trained surgeon for complex or recurrent cases and may be used in theatre to assist in the identification of fistulae.

Specific scenarios

A 31-year-old man presents with a perianal abscess. He has no co-morbidities and no previous history of perianal or inflammatory bowel disease. He has mildly raised inflammatory markers but is otherwise haemodynamically stable.

This patient will need an EUA and I&D of the abscess. Depending on local protocols the patient will be operated on the same or following day on the emergency operating list. There may be an 'abscess pathway' where the patient can be discharged home and brought back the following day

(inform them of the specific location and time), with the advice to return immediately if they develop any signs or symptoms of sepsis.

- Make the patient nil-by-mouth and prepare them for theatre.
- If you are competent at performing the procedure yourself, you may consent the patient. The benefits of the procedure are that it can be used to assess the size and location of the abscess, to determine the presence of a fistula, and to prevent sepsis. The risks are pain, bleeding, infection, recurrence and damage to the anal sphincter with resultant incontinence.

It is particularly important to explain the aftercare to the patient. The wound will be left open to prevent a reaccumulation of pus and will require regular dressings for a number of weeks whilst it heals by secondary intention. If the cavity has been packed during I&D, this should be removed before discharge, as this tends to cause needless pain for the patient. Simple alginate absorbable dressings with gauze should suffice.

If a fistula is detected during EUA, it is left alone as some will heal with resolution of the abscess; however, the patient should be followed up by a colorectal surgeon in case further investigation and treatment are required. They should be booked for an outpatient MRI within 6 weeks and seen as an outpatient shortly after. Antibiotics are not routinely prescribed post-operatively but may be required for those who are immunocompromised or diabetic.

A 64-year-old man with diabetes and a previous history of abscess/fistula presents with a perianal abscess associated with markedly raised inflammatory markers and systemic signs of sepsis.

This patient is unwell and will require admission, stabilisation and urgent I&D.

- Establish IV access and take bloods, including cultures.
- Start IV fluids and broad-spectrum IV antibiotics according to local guidelines and sepsis protocol (e.g. co-amoxiclav 1.2 g IV TDS if not penicillin allergic).
- Keep nil-by-mouth in preparation for theatre and work them up as previously mentioned. The patient should be prioritised on the emergency list.
- Monitor the blood sugar levels if they have diabetes and commence a sliding scale if indicated.
- If there is any evidence of necrotising infection, inform your seniors without delay as the patient will likely need urgent wound debridement. (See Chapter 23)

Pilonidal abscess

This is not a true perianal disease, but is a common condition often confused by inexperienced surgeons, so it is covered in more detail here.

A pilonidal sinus is a tract formed as a result of a local reaction to a hair follicle. The sinus usually occurs in the natal cleft. Whilst on-call, you are likely to see patients with a pilonidal abscess, which is a collection of pus adjacent to the natal cleft. Multiple pits may be present, with associated discharge or an area of erythema/fluctuance. Pilonidal abscesses are most common in hirsute males.

History and examination

The history, examination and routine investigations required in a pilonidal abscess are similar to those required for patients with a perianal abscess. There are, however, a few more specific questions to ask for pilonidal abscesses:

- *Duration of symptoms*: Patients may complain of buttock/natal cleft discomfort for a long time. Has it changed recently?
- Do they have a painful lump?
- Have they had this condition before? Any previous surgery? (Recurrent infections are common unless the underlying pilonidal sinus is excised.)

Specific scenarios

A patient with a pilonidal sinus but no associated abscess or discharge.

A pilonidal sinus is a visible pit or opening that may or may not be discharging, but does not have an associated tender, erythematous, fluctuant swelling of an underlying abscess (collection of pus). These patients can be reassured and discharged without antibiotics if encountered during an on-call shift. They should be referred for outpatient follow-up within 6–8 weeks with a colorectal surgeon and given advice on maintaining a good level of hygiene (daily washing with attention on keeping the skin clean and dry). Ideally the area should be free of hair.

A patient with a discharging pilonidal sinus but no associated abscess.

These patients can be managed similarly to those with a non-discharging sinus. Additionally, a course of oral antibiotics (usually flucloxacillin 1 g

QDS for 5–7 days if not penicillin allergic) should be prescribed and the patient is advised to return to the hospital if treatment fails or an area of tenderness/fluctuance develops, as they have active inflammation of the sinus tract causing the discharge and higher chance of abscess formation if left untreated.

A well patient with pilonidal disease and a definite area of fluctuance/abscess.

This patient will require an I&D in theatre. If the patient is well and the emergency theatre list full, the patient can return the next morning (check local policy) having fasted overnight.

- Make the patient nil-by-mouth.
- Consent and book for an I&D of pilonidal abscess.
- Explain the aftercare to the patient (mentioned previously) and need for outpatient follow-up to review the need for further surgery (excision of the pilonidal sinus ± closure) as definitive management to prevent recurrent symptoms.

All patients seen with pilonidal disease should have outpatient colorectal follow-up at 8–12 weeks to reassess disease severity and discuss elective pilonidal sinus excision.

An unwell, diabetic patient with pilonidal disease and a definite area of fluctuance/abscess and raised inflammatory markers.

Management will be as previously mentioned, however, this patient will require admission and prioritisation for theatre as they are at high risk (diabetes) and are prone to developing sepsis as they are immunosuppressed.

- Make nil-by-mouth and prepare for theatre.
- Start IV antibiotics (e.g. flucloxacillin 1 g IV QDS), IV fluids and an insulin sliding scale.
- Inform your seniors, theatre team and anaesthetist early.

Haemorrhoids (piles)

Haemorrhoids can be internal (arising from above the dentate line), or external (arising inferior to it). External haemorrhoids are more likely to be associated with pain. Complications of haemorrhoids include bleeding, pain, prolapse and strangulation (internal) and thrombosis (internal or external). You could easily encounter any of these presentations whilst on-call.

History and examination

The specific details to elicit are:

- Presence of bleeding and its appearance. (Is it bright red? Only present on the toilet paper or is it seen in the toilet bowl? Is it associated with stool? Dark/altered blood indicates that the bleeding source is more proximal in the colon and not of anorectal origin.)
- Previous history of haemorrhoids and how they were managed.
- Duration of symptoms.
- *Pain*: Acutely painful haemorrhoids make a diagnosis of thrombosed piles more likely.
- Sensation of a lump perianally.
- History of constipation and straining during defaecation.
- Any symptoms to suggest more sinister pathology, such as a change in bowel habit or weight loss. Further characterise/quantify these if present.
- Are they taking any relevant medications such as laxatives, constipating medications, antiplatelets, anticoagulants (warfarin/NOACs [novel oral anticoagulants]), or NSAIDs [nonsteroidal anti-inflammatory drugs]?

As part of a full examination focus on:

- *Abdominal tenderness*: This may suggest another cause of PR bleeding.
- Look for any frank bleeding externally, including the presence of clots or dried blood. If present, note the colour and appearance.
- Look for any external piles, or internal prolapsed piles – and note any discolouration suggesting thrombosis.
- Perform a DRE. Before proceeding, it may be beneficial to apply one or two syringes of Instillagel to numb the area and allow a more useful examination. If you have the experience and equipment it may be useful to perform proctoscopy if pain allows.
- *Gently palpate any prolapsed piles to assess tenderness*: Thrombosed piles are usually very tender.
- If not too tender, you can attempt to reduce the prolapsed piles.

Specific scenarios

A fit and well, haemodynamically stable 22-year-old patient with a small amount of PR bleeding and a clear diagnosis of haemorrhoids.

- Take bloods including FBC to check the Hb. A VBG (venous blood gas) will give a quick estimate of this.
- Ensure the patient is haemodynamically stable.
- Reassure the patient and discharge them with outpatient colorectal follow-up.

Most cases of bleeding piles resolve spontaneously with no need for any acute intervention. If the bleeding stops, the patient can be discharged with a 1-week course of a topical steroid cream e.g. Scheriproct applied twice daily to the affected area for 1 week (to reduce inflammation and symptoms of itching and irritation) and followed up in the colorectal outpatient clinic within 6–8 weeks. Advise the patient to increase their dietary fibre and liquid intake to avoid constipation or straining.

A patient with heart disease and AF (atrial fibrillation) who is on warfarin presents with PR bleeding. They are haemodynamically unstable with an Hb of 100 g/L. Examination findings are equivocal and there is ongoing bleeding.

Although the bleeding may be secondary to piles, it is important to rule out other causes of PR bleeding (see Chapter 3). The patient needs admission and close observation.

- Ensure IV access (x2) and send blood tests for Hb, clotting and a group and save.
- Cross-match the patient (x2–4 units depending on severity and response to treatment) and transfuse as necessary (transfusion should usually be performed if Hb <80 g/L with active bleeding, but discuss all PR bleeding with a senior first, as active bleeding in an unstable patient with an initially normal Hb would still require transfusion).
- Correct abnormal clotting function (see following paragraph relating to correction of derange clotting)

Some cases of bleeding piles (e.g. post-operative haemorrhoidectomy patients) may require surgery to stop the bleeding. A patient with abnormal clotting who is actively bleeding and unstable will need prompt reversal. Advice should be sought from the on-call haematologist particularly in complex situations (e.g. PE in the context of metallic heart valves) and for the approval of blood products.

The commonest abnormality is a raised INR (international normalised ratio) due to warfarin, corrected by immediate administration of vitamin

K IV followed by 25–50 units/kg prothrombin complex concentrate (PCC). This combination will achieve rapid reversal of INR (i.e. within 20 mins). Repeat the clotting after this and reassess the patient.

Such a case usually requires discussion with the on-call haematologist, who will authorise the release of the PCC if indicated. They will also advise on the management of unstable, actively bleeding patients taking NOACs.

If there is any doubt about the diagnosis, the patient will require an urgent flexible sigmoidoscopy/colonoscopy. This can be performed either as an inpatient or outpatient, depending on the persistence of bleeding. These patients should be stable and free of bleeding for at least 24 hours before being discharged. They will almost certainly need outpatient colorectal follow-up. See Chapter 3.

A stable patient with painful thrombosed haemorrhoids on examination but little or no PR bleeding.

These can be extremely painful, so ensure good analgesia and laxatives. Give the patient an ice pack (remember to cover with a towel to avoid thermal injury) to reduce the perianal swelling in an effort to reduce pain. Operative intervention is usually not necessary in the acute setting and the patient can be discharged after reassuring them that thrombosed haemorrhoids should resolve within a few days. However, some advocate surgical evacuation of the haematoma or haemorrhoid surgery in patients presenting less than 72 hours after the onset of initial symptoms, so discuss with your senior to clarify local policy.

For all patients with haemorrhoids ensure outpatient colorectal follow-up is arranged and discuss with seniors if unsure of the diagnosis, remembering that anal or rectal cancer can be mistaken for haemorrhoids.

Anal fissure

This is an ulcer in the anal canal mucosa, occurring distal to the dentate line. Fissures can be caused by excessive straining or constipation, leading to an initial tear in the mucosa. Following this, a vicious cycle of repeated trauma and a non-healing lesion perpetuates. It often presents with sharp pain on defaecation, which can be very severe, and is often described as a 'cutting' pain. It may be accompanied by a small amount of bright red blood per rectum caused by irritation and local trauma to the mucosa. In addition, it is important to enquire about frequency of bowel habit, straining, bleeding, tenesmus, and systemic symptoms such as weight loss, which may suggest a more sinister lesion.

On examination, fissures can be detected by gentle inspection of the anal mucosa whereby a linear tear in the mucosa is often visible. Do not attempt a full DRE. A deep fissure is characterised by a wide ulcer with visible white transverse fibres of the internal anal sphincter. A sentinel

skin tag may also be visible. In the acute setting, the aim should be to prevent straining and constipation. A trial of topical 2% diltiazem cream or 0.2% glyceryl trinitrate (GTN) ointment can be used for 6 weeks with a plan to follow the patient up in colorectal outpatients within 6 weeks, or 2 weeks if diagnostic uncertainty exists and malignant disease is a possibility.

Fistula-in-ano

Fistula-in-ano is a tract lined by granulation tissue which connects the anal canal to an opening in the perianal skin. They are classified according to the anatomy relating to the sphincter complex: intersphincteric, transsphincteric, suprasphincteric and extrasphincteric.

Fistula-in-ano is understood to be caused by the spread of infection from the anal glands residing in the intersphincteric space around the anal canal. The infection usually forms an abscess which may present acutely (see the section 'Perianal Abscess'). Over time, the tract formed by the spread of infection becomes epithelialised, leading to the formation of a fistula. Other important causes of fistula-in-ano include trauma (e.g. foreign body), Crohn disease, carcinoma, tuberculosis (TB) and radiation therapy, hence the importance of taking a full history including systemic symptoms, bowel habit and risk factors.

In the acute situation you are most likely to encounter patients who present with an abscess. The goal of treatment in this setting is to deal with the infection i.e. drainage of abscess and carry out a thorough EUA to look for the presence of a fistula tract. The patient should be followed up in 6 weeks in a colorectal clinic where the surgeon will determine if a fistula tract persists and organise an MRI scan to confirm the path of the tract. Definitive management would include laying open the fistula (if it only involves a small proportion of an intact internal anal sphincter) or inserting a seton if larger sphincteric involvement is confirmed.

Rectal prolapse

Rectal prolapse is a protrusion of the rectum through the anus. This can be full thickness, involving all layers of the wall of the rectum, or mucosal, involving the mucosal layer alone. It is most common in elderly women. Risk factors include connective tissues disorder such as Marfan and Ehlers–Danlos, history of anorexia nervosa, constipation and straining, high BMI and high-birth-weight babies delivered vaginally.

Acutely, you may be asked to see a patient with a painful prolapse. It is important to enquire about the aforementioned risk factors in the history and examine for any associated lesions such as ulcers and bleeding. You should attempt to reduce the prolapse using a liberal amount of Instillagel and applying gentle but firm pressure. In the majority of cases reduction should be achievable, however if not, involve

your seniors as the patient may require examination ± reduction under anaesthesia. Following reduction, management involves use of laxatives, high-fibre diet and avoidance of straining. The patient should be followed up in colorectal outpatient clinic within 6 weeks. For resistant cases of prolapse, definitive management is surgical via the abdominal (open or laparoscopic rectopexy) or perineal approach (Altemeier's or Delorme's procedures). The choice of procedure will depend on surgeon preference and patient comorbidity.

Anal cancer

Anal cancer is rare, accounting for approximately 4% of large-bowel malignancies. Most cancers are squamous cell carcinomas arising from the anal canal or perianal area, and a small proportion (10%) are adenocarcinomas arising from the glandular tissue. Other rarer forms include melanoma, lymphoma and sarcoma.

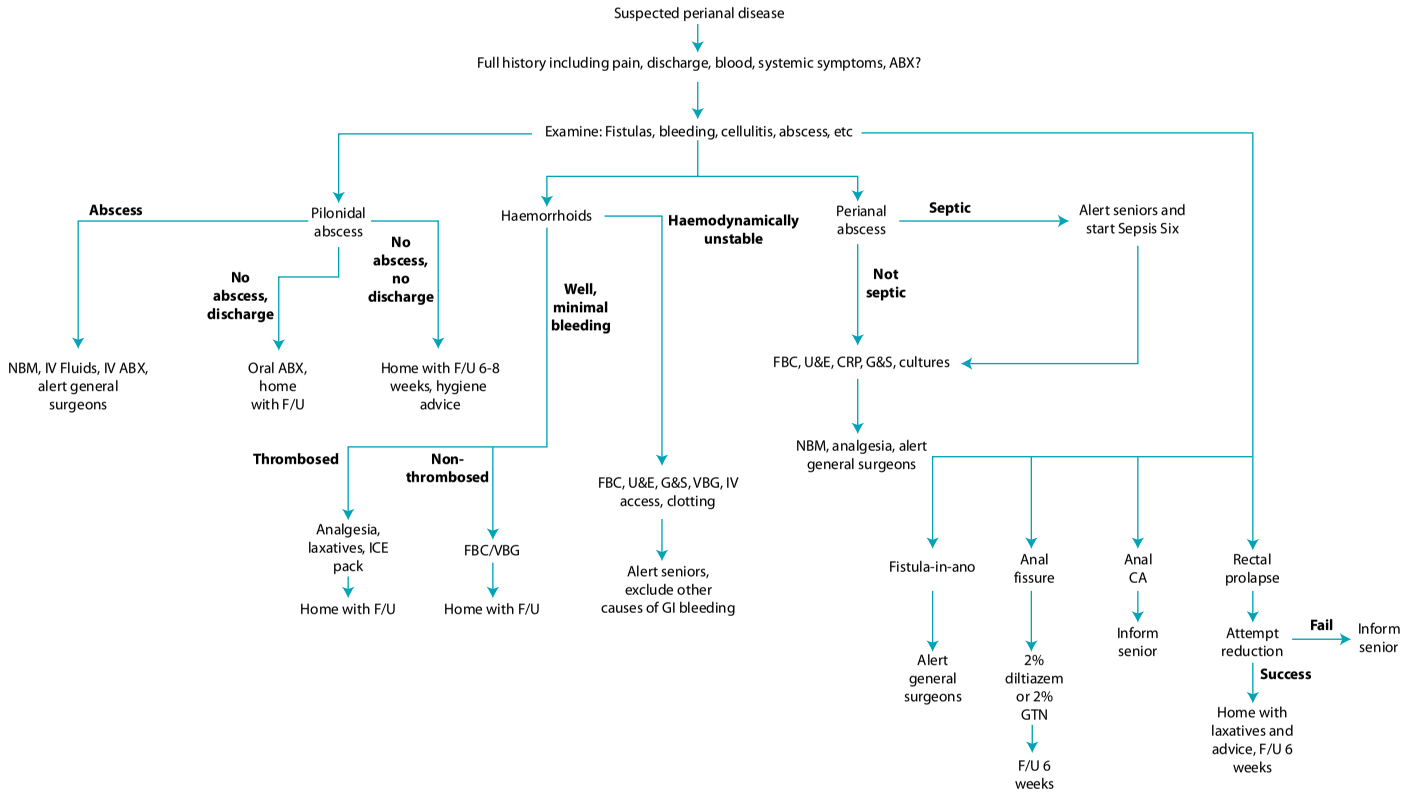
Risk factors for anal cancer include history of genital warts and human papilloma virus infection. The pathophysiology involves a progression from anal intraepithelial neoplasia (AIN) to carcinoma in situ and invasive carcinoma.

Patients may present with perianal pain, pruritus and/or bleeding. Examination may reveal an ulcerated lesion which may bleed. It is often mistaken for other pathology such as a deep anal fissure; therefore, take a full sexual history, examine for inguinal lymphadenopathy, and seek advice from your seniors if you are suspicious. Diagnosis is confirmed on biopsy. Treatment would typically involve combination chemoradiotherapy or surgical excision.

Summary algorithm

Key questions to ask and instructions to give over the phone when being referred a patient with an acute presentation of perianal disease:

1. Is there a previous history of perianal disease/abscess/fistula/inflammatory bowel disease?
2. What are the examination findings? Specifically, are there any signs of necrosis of the skin? (Immediately involve seniors if this is the case).
3. What are the observations? Any systemic signs of sepsis?
4. What are the inflammatory markers and Hb?
5. Establish IV access, ensure bloods taken for inflammatory markers and clotting, initiate IV antibiotics if indicated.
6. Keep the patient fasted and initiate their workup for theatre if an operation is required e.g. speak to anaesthetists, theatres and seniors.


Suspected perianal disease
Full history including pain, discharge, blood, systemic symptoms, ABX?
Examine: Fistulas, bleeding, cellulitis, abscess, etc
Abscess
Pilonidal abscess
No abscess, discharge
No abscess, no discharge
NBM, IV Fluids, IV ABX, alert general surgeons
Oral ABX, home with F/U
Home with F/U 6-8 weeks, hygiene advice
Haemorrhoids
Haemodynamically unstable
Well, minimal bleeding
Thrombosed
Non-thrombosed
Analgesia, laxatives, ICE pack
Home with F/U
FBC/VBG
Home with F/U
FBC, U&E, G&S, VBG, IV access, clotting
Alert seniors, exclude other causes of GI bleeding
Perianal abscess
Septic
Alert seniors and start Sepsis Six
Not septic
FBC, U&E, CRP, G&S, cultures
NBM, analgesia, alert general surgeons
Fistula-in-ano
Alert general surgeons
Anal fissure
2% diltiazem or 2% GTN
F/U 6 weeks
Anal CA
Inform senior
Rectal prolapse
Attempt reduction
Fail
Inform senior
Success
Home with laxatives and advice, F/U 6 weeks

Chapter 8

Upper gastrointestinal emergencies

Suroosh Madanipour

When dealing with an upper gastrointestinal (UGI) emergency (or any surgical emergency) you should approach your patient in an ABCDE (airway, breathing, circulation, disability, exposure) manner. If you are alone, it is essential to prioritise resuscitation in any acutely unwell patient over taking a history or ordering investigations. If a patient is very unstable, ensure that a peri-arrest call is put out so that the patient can be dealt with effectively with additional support.

You should follow ALS (advanced life support) or CCrISP (care of the critically ill surgical patient) guidelines when managing these patients. You should also consider whether your patient is showing signs of sepsis – if this is the case you should perform the 'Sepsis Six' (Surviving Sepsis Campaign):

1. Start the patient on high-flow oxygen.
2. Send off blood cultures.
3. Start empirical IV antibiotics.
4. Measure serum lactate (VBG [venous blood gas]) and send off a full blood count (FBC).
5. Start IV fluid resuscitation.
6. Insert a catheter and accurately measure urine output.

Sepsis is diagnosed when a patient has systemic inflammatory response syndrome (SIRS) in the presence of infection. SIRS is diagnosed if two or more of the following are present:

- Temperature <36°C or >38°C
- Heart rate >90 beats per minute
- Respiratory rate >20 breaths per minute or $PaCO_2$ <32 mmHg
- White cell count $<4 \times 10^9$ or $>12 \times 10^9$/L

If your patient is showing signs of SIRS then they must be adequately resuscitated.

> Note:
> - Blood pressure is not included in this system.
> - SIRS is not only caused by infection but can also be a response to any form of stress, including trauma, burns and pancreatitis.

Sepsis = SIRS + source of infection

Severe sepsis = sepsis + end organ dysfunction

Septic shock = severe sepsis with hypotension that is refractory to IV fluids

> **Tip:** Patients with severe sepsis or septic shock require urgent ITU (intensive treatment unit)/HDU (high-dependency unit) input for organ support ± inotropes and close monitoring.

Peptic ulcer disease

Peptic ulcer disease occurs when the mucosa of the lower oesophagus, stomach, duodenum or small bowel breaks down and becomes vulnerable to breach, most commonly secondary to acid.
Classification:

- *Gastric ulcer (GU)*: Associations include *Helicobacter pylori* (*H. pylori*), alcohol, smoking, NSAIDs (nonsteroidal anti-inflammatory drugs).
- *Duodenal ulcer (DU)*: Associations include cases of *H. pylori* (85%), high acid secretion, smoking, NSAIDs.
- *Atypical*: e.g. High gastrin secretion in Zollinger–Ellison syndrome, ectopic gastric mucosa or acid secretion.

Clinical features of peptic ulcer disease include nausea and epigastric pain. Pain is classically worsened by food in GU and relieved by food in DU. Pain is also worse in the morning in duodenal ulceration.

Diagnosis is made at endoscopy, where antral biopsy can further diagnose *H. pylori* (alternatively CO_2 breath test).

Peptic ulcer disease can be managed as an outpatient with conservative and medical measures including stopping smoking, withdrawing NSAIDs, reducing alcohol and caffeine intake, PPIs (proton-pump inhibitors) (e.g. omeprazole 40 mg OD) or H2 antagonists if not tolerated (e.g. ranitidine 150 mg BD) and antacids (e.g. Gaviscon). *H. pylori* can be eradicated

with triple therapy (follow local hospital policy). The optimum regimen, according to NICE (National Institute for Health and Care Excellence), consists of a full-dose PPI, e.g. lansoprazole 30 mg BD with amoxicillin 1 g BD and clarithromycin 500 mg BD, or (in the case of penicillin hypersensitivity) metronidazole 400 mg BD and clarithromycin 250 mg BD, all given for 7 days.

For the surgical SHO (senior house officer) on call, peptic ulcer disease can manifest as two serious and common emergencies. These are acute UGI bleeding and UGI perforation. Initial management is described later but remember, as with all surgical emergencies, you should assess in an ABCDE manner, start appropriate initial management/resuscitation and escalate to your seniors early.

Acute UGI bleeding

This is defined as bleeding proximal to the duodenojejunal flexure and can present as haematemesis or melaena. Rarely a large UGI bleed will present with fresh PR blood and haemodynamic instability (see Chapter 3). This is usually managed by the on-call medical team, but the general surgeon must be able to deal with an acute UGI bleed as surgery may be required in refractory cases. It is a potential complication of benign/malignant peptic ulcer disease but can be secondary to other conditions such as:

- *Oesophageal varices*: Severe, massive-volume blood loss.
- *Oesophageal trauma*: Mallory–Weiss tear due to repeated vomiting or retching, or oesophageal rupture in Boerhaave's syndrome.
- Vascular malformations (e.g. telangiectasia or Dieulafoy lesion – solitary large tortuous submucosal arteriole).
- *Aortoenteric fistula*: Severe, massive-volume blood loss.

History and examination

The specific details to elicit are:

- The volume, colour and consistency of the blood (coffee-ground vomitus suggests the blood has undergone oxidisation in the stomach).
- Black tarry stools are suggestive of melaena (with associated offensive smell). Ask about iron supplements and other medications, including anticoagulants.
- *Risk factors for peptic ulcer disease*: Smoking, NSAIDs, alcohol excess, burns (causing reduced plasma volume, ischaemia, and necrosis of gastric mucosa), Curling ulcer, ITU admission, raised intracranial pressure, major trauma, pancreatitis.

- *Risk factors/features of malignancy*: Smoking, family history, weight loss, etc.
- *Risk factors for a Mallory–Weiss tear*: Vomiting/retching.
- *Risk factors for aortoenteric fistula*: UGI or vascular surgery (e.g. open AAA [abdominal aortic aneurysm] repair) or inflammatory bowel disease.
- *Risk factors for varices*: Alcohol dependence, cirrhosis.

Specific scenarios

A patient with a history of vomiting/retching and low-volume fresh red bleeding who is haemodynamically stable.

- Assess the patient using an ABCDE approach.
- Review their observations and monitor their heart rate and blood pressure.
- Take routine bloods including FBC, U&E (urea and electrolytes), LFTs (liver function tests) and CRP (C-reactive protein).
- Perform an erect CXR to rule out perforation.

Low-volume haematemesis can occur in patients who have been vomiting/retching due to a small tear in the mucosa (Mallory–Weiss tear). It is normally benign and resolves on its own. Once the bleeding has resolved, and provided the blood tests and chest X-ray are normal, these patients can usually be discharged and followed up with a routine outpatient OGD (oesophagogastroscopy) provided there are no red flags to suggest malignancy (in which case this should be done within 2 weeks as a target referral). You should discuss all of these patients with a senior before discharging them.

A patient with large-volume haematemesis and epigastric pain, coffee-ground vomiting, associated melaena and haemodynamic instability.

- Assess the patient using an ABCDE approach.
- Monitor heart rate, blood pressure and other observations regularly.
- Establish wide-bore IV access x2, send bloods for FBC, U&E, CRP, clotting, group and save, VBG (to establish immediate Hb) and LFTs. Cross-match at least x4 units of packed red cells if large-volume bleed.
- **Patients with UGI bleed do not drop their haemoglobin levels immediately; it takes several hours for haemodilution to occur. Do not be reassured by an initial normal Hb result.**

- Give IV crystalloid ± O-negative blood depending on clinical condition of patient (give the latter if unstable and unable to wait for blood to be cross-matched). Call '2222' in emergency situations to initiate massive haemorrhage protocol in cases of large-volume blood loss.
- Catheterise and monitor urine output.
- Start IV PPI (stat dose 40 mg omeprazole IV followed by an infusion of 80 mg omeprazole in 100 mL normal saline at 10 mL/hour for 72 hours).
- Correct clotting abnormalities after discussion with haematology, using vitamin K, fresh frozen plasma (FFP) or prothrombin complex concentrate (PCC) as appropriate.
- Order an erect chest X-ray to rule out air under the diaphragm, suggestive of perforation.
- Get urgent senior input, including an anaesthetist, as the airway may need to be protected in significant UGI bleeds. If not already involved, a senior gastroenterologist should be informed early during resuscitation for endoscopic control of bleeding.

This patient will likely require urgent endoscopy to establish a diagnosis and enable treatment. UGI bleeding can be managed during endoscopy in a number of different ways, ideally as a combination of any two of the following:

- Adrenaline injection
- Heating probe coagulation
- Variceal banding
- Clipping vessel
- Haemoseal spray

Further management will depend on the result of the OGD. If the patient continues to bleed or if OGD is unsuccessful, they will require surgery or radiological embolisation depending on patient stability, local resources and expertise. Interventional radiology should be considered first in poor surgical candidates. You should urgently prepare and book the patient for theatre, speak to the anaesthetists and alert the theatre coordinator.

Glasgow-Blatchford Score

The Glasgow-Blatchford Score (GBS) is a screening tool that can be used to assess the likelihood that a patient with UGI bleeding will need intervention in the form of a blood transfusion or OGD. It is less subjective than clinician assessment and can be simply

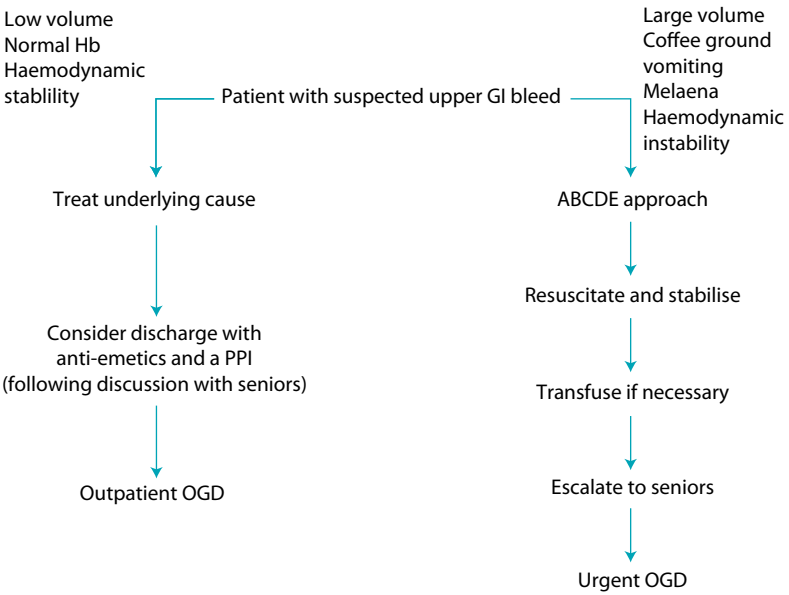
calculated using Table 8.1. A score of 6 or more indicates >50% need for intervention.

The Rockall Score (easily found on an internet search) can then be used to predict patient outcome (mortality) based on a number of clinical factors and endoscopic findings.

Table 8.1 Glasglow-Blatchford scoring system

Admission parameter	Score
Blood urea (mmol/L)	
6.5 to <8.0	2
8.0 to <10.0	3
10.0 to <25.0	4
>25.0	6
Haemoglobin for men (g/dL)	
12.0 to <13.0	1
10.0 to <12.0	3
<10.0	6
Haemoglobin for women (g/dL)	
10.0 to <12.0	1
<10.0	6
Systolic blood pressure (mmHg)	
100–109	1
90–99	2
<90	3
Other markers	
Pulse >100 beats/minute	1
Presentation with melaena	1
Presentation with syncope	2
Hepatic disease	2
Cardiac failure	2

Summary algorithm



Low-volume bleed with normal Hb and haemodynamic stability:

- Treat underlying cause.
- Consider discharge with anti-emetics (e.g. cyclizine 50 mg TDS) and PPI (omeprazole 40 mg OD) (following discussion with seniors).
- Outpatient OGD should be ordered as appropriate.

Large-volume bleed/coffee-ground vomiting with associated melaena/epigastric pain or haemodynamic instability:

- ABCDE approach.
- Resuscitate and stabilise.
- Transfuse if necessary.
- Escalate to seniors.
- Urgent OGD.

UGI perforation

UGI perforation secondary to peptic ulcer disease is a surgical emergency which requires prompt diagnosis, stabilisation and assessment for operative management. This is covered in Chapter 11.

Complications of bariatric surgery

Bariatric surgery is an expanding speciality and one that is likely to be encountered with increasing incidence during a surgical on-call shift. In addition to the general complications associated with major abdominal surgery, there are some complications specific to bariatric surgery. We will discuss the most common of these post-operative complications here.

Roux-en-Y gastric bypass

In a Roux-en-Y gastric bypass the stomach is divided proximally to form a small pouch which is connected directly to the jejunum. A Y loop is formed from remaining stomach and duodenum, with anastomosis to the distal jejunum (see Figure 8.1).

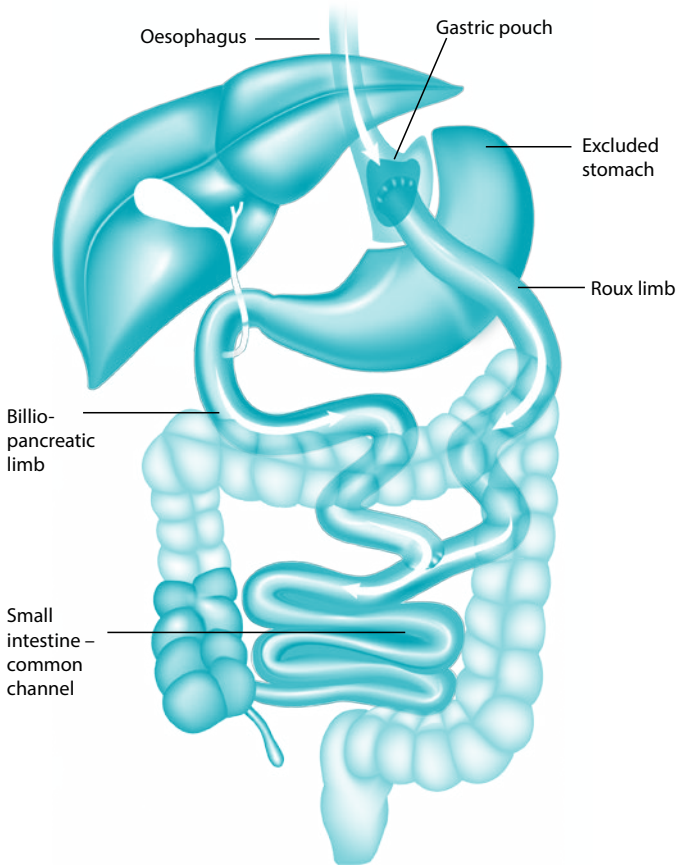


Figure 8.1 Roux-en-Y bypass anatomy.

Specific complications:

- *Anastomotic leak*: Tachycardia, hypotension, fevers and abdominal pain with features of peritonitis (see Chapter 19).
- *Dumping syndrome*: Caused by rapid transit of hyperosmolar food into the small bowel and subsequent movement of fluid via osmosis. Symptoms include flushing, dizziness, palpitations and diarrhoea. Initial management should include resuscitation and stabilisation, including fluid and electrolyte replacement and glucose monitoring. Medical treatment can include the use of acarbose, which slows carbohydrate absorption and may decrease the time between hyperglycaemia and insulin response. Any medical and surgical management should be discussed with a senior gastroenterologist or bariatric surgeon.
- *Anastomotic stricture*: Presents with insidious onset features of bowel obstruction.
- Internal hernia (high risk of ischaemic segment and acute deterioration unless corrected surgically in an urgent manner following initial resuscitation).
- *Anastomotic ulcer*: Presents with epigastric pain or UGI bleeding.
- Malnutrition due to absorption deficiencies.

Gastric banding

In gastric banding a band is placed around the stomach distal to the gastro-oesophageal junction, with a filling port tunnelled underneath the skin. The band is then inflated by a variable amount.

Specific complications:

- *Band slippage or gastric herniation*: Severe upper abdominal pain and vomiting due to gastric obstruction with possible fundal ischaemia. Diagnosis is suspected on AXR (loss of angulation of band) and confirmed by a contrast swallow study. Treatment requires needle decompression of gastric band followed by urgent band removal at a specialist bariatric or UGI unit.
- *Gastric necrosis (tight band causing ischaemia)*: Confirmed on CT AP (CT abdomen and pelvis) and requires urgent surgical intervention. Always discuss with your senior and nearest bariatric unit for advice on management of all bariatric complications.
- *Band erosion*: Usually gradual onset, non-specific epigastric pain with or without obstruction. Diagnosis confirmed on OGD. Requires surgical removal.

Sleeve gastrectomy

Sleeve gastrectomy is an irreversible procedure whereby the majority of the stomach is removed, leaving a cylindrical remnant formed from the remaining lesser curvature.

Specific complications:

- *Post-operative bleeding*: Tachycardia, hypotension, bloody drain output, falling Hb. Transfuse as appropriate and correct coagulation deficiencies. Involve seniors immediately if suspected.
- *Leakage*: Tachycardia, hypotension, fever, abdominal pain, warm peripheries and rising inflammatory markers.

Specific scenarios

A post-operative gastric bypass patient with vomiting and mild abdominal pain. They have a soft abdomen, are haemodynamically stable and have normal blood results.

Mild abdominal pain and vomiting is common post-operatively and can normally be managed with simple painkillers and anti-emetics. You should, however, rule out more serious complications first, by way of thorough history, examination and assessment and discussion with an experienced senior.

- ABCDE approach.
- Ensure anti-emetics and IV fluids prescribed.
- If any concerns, request appropriate imaging (erect CXR, CT AP) and escalate as appropriate.

A post-operative gastric bypass patient with significant pain, haemodynamic instability, falling Hb or rising inflammatory markers.

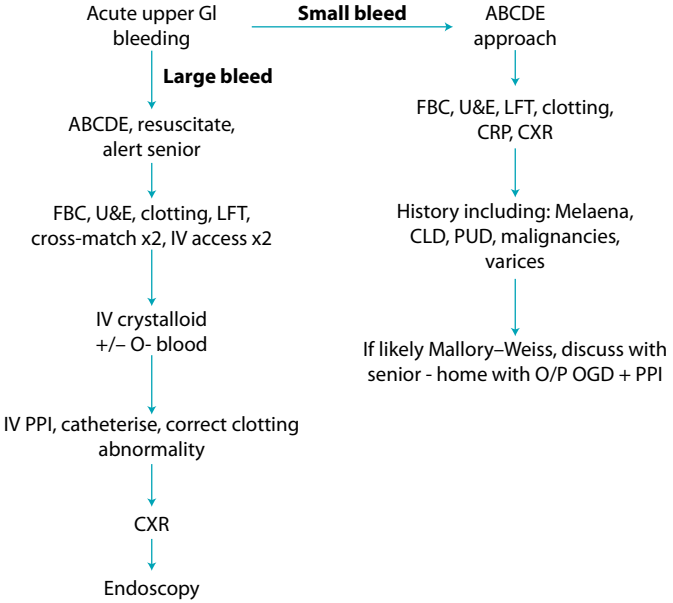
- ABCDE approach.
- Apply oxygen and establish wide-bore IV access.
- Take bloods for FBC, U&E, CRP, coagulation screen and group and save. VBG for acid-base/lactate/Hb/glucose.
- Catheterise and monitor urine output.
- Erect CXR to exclude perforation.
- Early discussion with seniors regarding complex imaging e.g. CT AP or Gastrografin swallow.

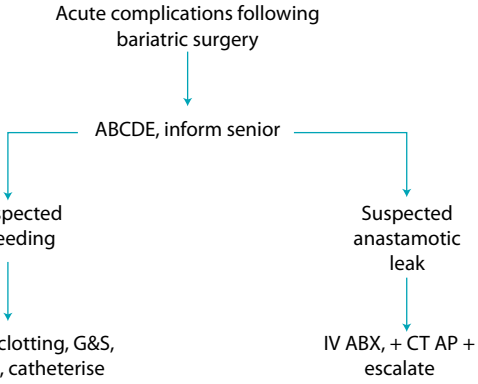
A patient presenting to accident and emergency department months/years after a bariatric procedure.

You should assess these patients as you would any other surgical patient and ensure you rule out non-bariatric surgery–related causes and their symptoms first.

- History and examination.
- Bloods including FBC, U+E, CRP, lactate.
- CXR and AXR.
- Escalate to seniors.
- Note that gallstones are associated with weight-loss surgery.

Summary algorithm


Acute upper GI bleeding
Small bleed
ABCDE approach
Large bleed
FBC, U&E, LFT, clotting, CRP, CXR
ABCDE, resuscitate, alert senior
History including: Melaena, CLD, PUD, malignancies, varices
FBC, U&E, clotting, LFT, cross-match x2, IV access x2
If likely Mallory–Weiss, discuss with senior - home with O/P OGD + PPI
IV crystalloid +/– O- blood
IV PPI, catheterise, correct clotting abnormality
CXR
Endoscopy


Acute complications following bariatric surgery
ABCDE, inform senior
Suspected bleeding
Suspected anastamotic leak
FBC, U&E, clotting, G&S, VBG, CXR, catheterise
IV ABX, + CT AP + escalate

Key questions to ask over the phone when being referred a patient with a history of bariatric surgery which will make your time on-call easier:

1. What precise operation has the patient had and how long ago was it?
2. What are the observations?
3. What are the findings on examination?
4. Any haematemesis/melaena?
5. Has the patient been cannulated? Have blood tests including lactate, group and save and clotting been sent?
6. Has the patient had an erect CXR and AXR?

Chapter 9
Acute appendicitis

Amelia Davidson

The vermiform appendix is a tubular structure attached to the base of the caecum which can become inflamed, resulting in acute appendicitis. This is generally caused by obstruction of the appendix lumen due to faecoliths (hardened lumps of faeces) or appendicoliths (calcified deposits in appendix) in adults and lymphoid hyperplasia in children. The incidence of acute appendicitis is 52 per 100,000 in the UK and the peak incidence is between 10 and 30 years of age. The overall lifetime risk for developing acute appendicitis is 8.6% in males and 6.7% in females.

Acute appendicitis tends to present with migratory pain (umbilicus to right lower quadrant), anorexia and nausea. It is a common cause of surgical admissions and, if left untreated, mortality is high due to peritonitis and shock.

The key points to consider in acute appendicitis admissions are:

- Prompt and appropriate resuscitation to prepare for surgery.
- The administration of broad-spectrum antibiotics in patients who present with suspected perforated appendicitis, an abscess or collection or in certain high-risk surgical patients.
- To involve senior team members early if you think the patient has the potential to deteriorate (including your registrar and critical care team).

History and examination

Acute appendicitis is well known for its varied presenting features, so it is important to adhere to a well-structured history and examination.

Specific details to elicit are:

- Assess the nature and severity of the pain (typical colicky peri-umbilical pain migrating to the right lower quadrant becoming constant and sharp in about 50% of cases).

- Enquire about the timescale (usually gradual onset within 48 hours).
- Any associated symptoms such as anorexia, nausea, vomiting or aggravation of pain by movement.
- Any constitutional symptoms that might suggest an alternative diagnosis, for example, weight loss, diarrhoea and rectal bleeding in inflammatory bowel disease (IBD) affecting the terminal ileum, or swinging pyrexia in a pelvic abscess caused by diverticulitis.
- Has there been a change in bowel habit? Any changes in diet, unwell family members or recent travel which might suggest gastroenteritis?
- A full gynaecological history in a female, including last menstrual period, sexual history, dyspareunia and previous ultrasound scan results.
- Previous abdominal surgery.
- A full past medical and developmental history in children, including any recent viral illnesses which might suggest mesenteric adenitis.
- When the patient last ate and drank and allergy status.

As part of a full examination, focus on:

- Is the patient showing signs of sepsis?
- Is there localised right lower quadrant pain or generalised peritonitis?
- Can you palpate a right lower quadrant mass? This may indicate an appendix mass or abscess.
- In the elderly: Is the patient confused/delirious?
- In children: Are they quiet and withdrawn or interacting and playing? Are the parents concerned?
- Always examine the testicles in boys as testicular pain can refer to the abdomen.
- The presence of percussion tenderness, rebound tenderness or guarding in the right lower quadrant has high diagnostic value.
- *Rovsing's sign may be present*: Pain in the right iliac fossa (RIF) when deep pressure is applied in the left iliac fossa.
- *McBurney's sign may be present*: This is tenderness at McBurney's point (one-third of the distance from the anterior superior iliac spine to the umbilicus, on the right side of the abdomen). It corresponds to the location of the base of the appendix. This sign is positive if the patient is most tender at this point.
- *Psoas sign*: Increased pain during passive extension of the right hip.
- *Obturator sign*: Pain felt on passive internal rotation of a flexed hip.

Investigations

- Routine bloods should be ordered, including:
  - FBC (full blood count) and CRP (C-reactive protein): WCC (white cell count) can show leucocytosis and neutrophilia. CRP helps confirm the presence of inflammation.
  - *Renal function*: Electrolyte imbalances can occur with vomiting and a creatinine level will be required if a CT abdomen and pelvis (CT AP) with contrast is required.
  - *Group and save with clotting*: If the patient requires surgery, these are required as part of the pre-operative workup.
- Urinalysis
  - To rule out a urinary tract infection (UTI).
  - To check for pregnancy and consider ectopic pregnancy. Remember appendicitis can occur in pregnancy (1/1000) and has a greater risk of mortality, including foetal mortality, especially in perforation.
  - Blood and leucocytes are commonly seen in the urine in intra-abdominal inflammation. Do not presume this to represent an UTI if symptoms and signs suggest otherwise.
- Erect chest X-ray
  - The primary role is to rule out a perforated viscus (including appendix) which may show as air under the diaphragm on an erect chest X-ray.
- Venous blood gas
  - Check for a metabolic acidosis, negative base excess and raised lactate signifying sepsis and/or perforation.

Specialist investigations following discussion with seniors

Diagnosis of acute appendicitis is a clinical one. The investigations listed here will generally only serve to confirm the diagnosis in the presence of equivocal findings or to rule out an alternative diagnosis.

- Ultrasound abdomen
  - This has a sensitivity of 86% and specificity of 81% in acute appendicitis.
  - It is operator-dependant and should only be used in conjunction with high clinical suspicion and laboratory markers. Appendicitis is diagnosed when an aperistaltic non-compressible tubular structure is seen with a diameter >6 mm.
- CT AP
  - This has a sensitivity and specificity of 95% in acute appendicitis.
  - Appendicitis can be diagnosed when an abnormal appendix or calcified appendicolith are seen alongside localised inflammation, free fluid or appendix diameter >6 mm.

Specific scenarios

Where a young female presents with RIF tenderness, is haemodynamically stable and has mildly elevated inflammatory markers.

The diagnosis here is not clear, so ensure a thorough history has been taken, including a gynaecological history: Pregnancy status? Regular menstrual cycle or any menorrhagia/dysmenorrhoea? Does she ever have pain mid-cycle (mittelschmerz)? Has she ever been investigated with US pelvis/transvaginal US?

- Perform urinalysis and a pregnancy test.
- Consider asking a gynaecology team to review the patient.
- The current 'gold standard' in women where the diagnosis is unclear is active observation with regular re-examination.
- An abdominal and pelvic ultrasound would likely be indicated in this patient.

Where a young male presents with RIF tenderness, is haemodynamically stable and has raised inflammatory markers.

Recent onset abdominal pain with anorexia in a previously well young male is highly suspicious of appendicitis, but remember your differentials, including IBD.

- Ensure you examine the loin/flanks and external genitalia.
- Keep nil-by-mouth and discuss with your senior. Many of these patients will go on to have surgery (open or laparoscopic appendicectomy).
- There is an emerging role for conservative management of uncomplicated appendicitis with antibiotics, however, this should be a senior-led decision.
- Do not start antibiotics without senior approval as this can lead to diagnostic uncertainty.

Where a 65-year-old male presents with RIF pain and collapse, is pale, sweaty and haemodynamically unstable.

This is highly suspicious for a perforated hollow viscus (appendix or diverticula) but you MUST consider other differentials including ruptured AAA (abdominal aortic aneurysm) or mesenteric ischaemia.

- Resuscitate the patient with IV (intravenous) fluids, give analgesia, antibiotics and anti-emetics, monitor fluid status with a urinary catheter and immediately contact a senior.

- After urgent senior discussion, these patients may either have a CT AP with contrast or a laparotomy.

If the patient is showing clinical signs of a perforated abdominal viscus (ruptured appendix), early discussion with your registrar or consultant ± critical care outreach or ITU (intensive treatment unit) is indicated.

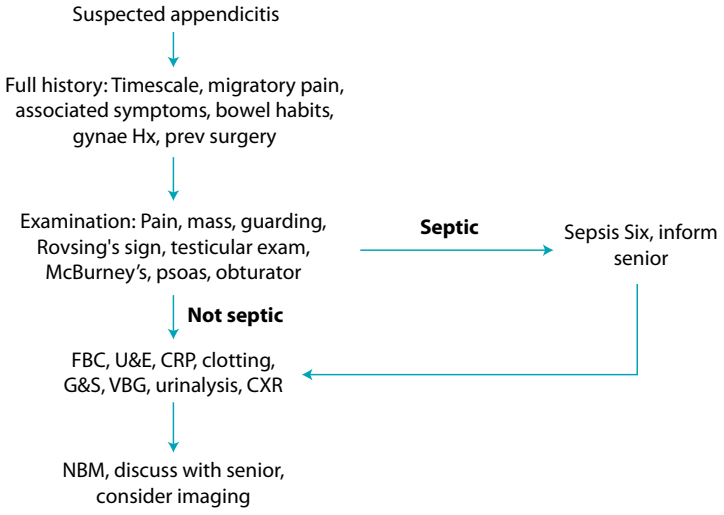
Natural sequelae

Hospital admissions typically last between a few hours to a few days, but can be several weeks. Recovery is generally faster if the appendix did not rupture. Most patients can eat and drink on the same day following their surgery. It is highly recommended that patients sit on the edge of the bed and mobilise as early as possible. Analgesia can be given to facilitate this. All surgical patients should wear compression stockings during their hospital stay.

Patients must be closely monitored as some will go on to develop complications such as:

- *Early*: Paralytic ileus managed conservatively and caecal stump leak or iatrogenic bowel injury requiring re-operation.
- *Late*: Primary wound or port site infection, wound haematoma or seroma (collections of blood or serous fluid, respectively), wound dehiscence, localised abscess or intra-abdominal collection (usually pelvic, but also interloop or subphrenic abscess) and enterocutaneous fistula.

Summary algorithm


Suspected appendicitis
Full history: Timescale, migratory pain, associated symptoms, bowel habits, gynae Hx, prev surgery
Examination: Pain, mass, guarding, Rovsing's sign, testicular exam, McBurney's, psoas, obturator
Septic
Sepsis Six, inform senior
Not septic
FBC, U&E, CRP, clotting, G&S, VBG, urinalysis, CXR
NBM, discuss with senior, consider imaging

Key questions to ask on the phone when being referred suspected appendicitis which will make your time on-call easier:

1. *Site and nature of the pain*: Has it suddenly started or been increasing in intensity over 48 hours?
2. What are the findings on abdominal exam? E.g. guarding, percussion tenderness, peritonism.
3. Pregnancy status if female.
4. What are the blood test/urinalysis results?
5. Have they performed an erect chest X-ray?
6. Has the patient been cannulated and IV fluids started?

Chapter 10
Hernias

Jason Hol-Ming Wong

A hernia is an abnormal protrusion of a hollow viscus through a defect in the wall of its containing cavity. Inguinal, femoral and umbilical hernias are the most common types of abdominal wall hernia that you will encounter as a surgical junior doctor. Epigastric, incisional and para-umbilical hernias are also commonly seen.

Many hernias are asymptomatic, however, complications can be life threatening. A well-structured history and examination is therefore vital for assessing the severity of the presentation.

The key points to consider in hernia admissions are:

- To assess whether the patient requires admission or can be managed as an outpatient.
- To recognise complications such as obstruction and strangulation early, and to manage them appropriately.
- To resuscitate the patient appropriately and determine the need for and timing of surgery e.g. if the hernia becomes strangulated.

History and examination

The specific details to elicit are:

- Is the hernia causing pain? If so, what is the severity and nature of pain?
- Enquire about the history and course of the hernia. When did they first notice it?
- Identify symptoms of obstruction (colicky abdominal pain, loss of appetite, vomiting, constipation, inability to pass wind or open bowels, abdominal distension).
- Many patients are able to reduce their own hernias. Ask if they are still able to do this. If not, how long has it been irreducible?
- Have they been in hospital before with the same problem?

- Any previous surgical repair of the hernia or other abdominal surgery?
- Have they been seen before regarding the hernia and are there any plans to repair it?
- Does the patient have symptoms that could suggest other emergency pathologies like ischaemic bowel (abdominal pain after eating if chronic or severe sudden onset abdominal pain if acute with diarrhoea or bloody stools) or abdominal aortic aneurysm (sudden onset abdominal pain that is radiating to the back and 'tearing' in nature, associated sweating and clamminess)?

As part of the full examination, focus on:

- Does the patient have an 'acute abdomen' i.e. peritonitis, guarding?
- Assess the patient's nutritional and hydration status (skin turgor, mucous membranes and blood pressure).
- Where is the hernia and what type is it?
- If the hernia is in the groin, is it above and medial to the pubic tubercle (inguinal) or below and lateral (femoral)? This is important as femoral hernias are more likely to strangulate.
- Is the hernia reducible? Ask the patient to try and reduce it.
- If it is an inguinal hernia, attempt to differentiate between direct and indirect by reducing it and putting pressure on the deep inguinal ring (found above the midpoint of the inguinal ligament between pubic tubercle and anterior superior iliac spine). Then ask the patient to cough. If the hernia is indirect, pressure on the deep inguinal ring will stop it from protruding in most cases (although this is not always the case). A direct hernia will not be controlled by this pressure.

Tip: When reducing a hernia, use the flat of your hand to roll the hernia towards the contralateral shoulder.

Does the patient have localised tenderness over the hernia or are they peritonitic?

Routine investigations

If the patient presents with an uncomplicated reducible inguinal hernia, they may not need any immediate investigations. These patients can be considered for routine surgical repair where pre-operative investigations should be ordered.

Generally, surgery is offered to patients with symptomatic inguinal hernias. Asymptomatic hernias can be managed conservatively but there remains a risk of strangulation and elective repair may be advised.

For patients presenting with complicated hernias, the following investigations should be ordered:

Routine blood:

- *FBC (full blood count) and CRP (C-reactive protein)*: Inflammatory markers may be raised if the patient has perforated.
- *Renal function*: Will be required if a CT (computerised tomography) scan with contrast is needed.
- *Group and screen with clotting*: If the patient requires surgery, these will be required as part of the pre-operative workup.
- *VBG (venous blood gas)*: A raised lactate with associated metabolic acidosis might suggest ischaemic bowel.
- *Erect chest X-ray*
  - To look for air under the diaphragm.
- *Abdominal X-ray*
  - To help rule out obstruction.
- *ECG (electrocardiogram)*
  - As part of the pre-operative assessment if working the patient up for theatre.

Specialist investigations following discussion with seniors

- USS (ultrasound scan)
  - When clinical findings are equivocal, a USS can be performed to help confirm the presence of a hernia or what type of hernia it is. Usually as an outpatient.
- CT AP (CT abdomen and pelvis)
  - If the patient has presented with a strangulated or obstructed hernia, a CT scan may be ordered to assist in pre-operative planning. This should only be performed in stable patients. Unstable patients may have to go straight to theatre after initial resuscitation.

Specific scenarios follow

A 55-year-old patient presents with painful left inguinal hernia.

- *Mild cases*: If the hernia is reducible, the patient may be safely discharged with outpatient follow-up (6 weeks) or listed for surgery. Hernias are frequently uncomfortable and this is an indication for elective repair.

- *Severe cases*: If you are unable to reduce the hernia, it may be strangulated and require urgent repair. You should get early senior involvement.

If the hernia was previously reducible and the patient is now unable to reduce it, the surgical team should attempt to do so (this may require opiate analgesia first). If the hernia is successfully reduced and the clinical picture improves, the patient will either be operated upon non-urgently during their admission or discharged with outpatient follow-up (6 weeks) as guided by your seniors.

Always consider your differential diagnosis and ALWAYS discuss with a senior before discharging these patients. Life-threatening pathology such as abdominal aortic aneurysms can present with lower abdominal pain.

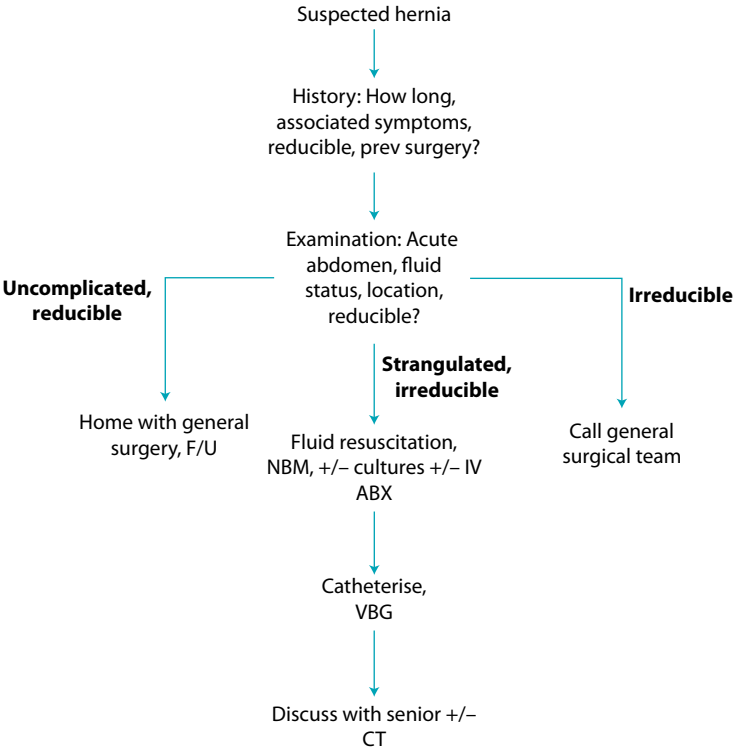
Indications for admission in these patients include uncontrolled pain, significant co-morbidities, deranged blood results, uncertain diagnosis, and irreducible or tender hernia.

Where the patient has an irreducible strangulated hernia:

- Start fluid resuscitation and analgesia. If there are signs of peritonitis then perform cultures and commence IV (intravenous) antibiotics (as per hospital policy, such as IV co-amoxiclav 1.2 g TDS) if no penicillin allergy, before getting early senior review.
- Keep nil-by-mouth and work them up for theatre.
- Insert NG (nasogastric) tube if they are obstructed.
- Catheterise to monitor urine output.
- Perform a VBG (if haemodynamically compromised, perform an ABG [arterial blood gas]).
- Organise an urgent CT AP (after senior discussion), unless they are too unstable to safely transfer to the CT scanner. Your senior may prefer to take the patient straight to theatre for operative repair.

This patient will most likely require an emergency hernia repair. However, if the strangulation has led to a perforation, an emergency laparotomy will most likely be performed (see Chapter 11).

Summary algorithm


Suspected hernia
History: How long, associated symptoms, reducible, prev surgery?
Examination: Acute abdomen, fluid status, location, reducible?
Uncomplicated, reducible
Strangulated, irreducible
Irreducible
Home with general surgery, F/U
Fluid resuscitation, NBM, +/– cultures +/– IV ABX
Call general surgical team
Catheterise, VBG
Discuss with senior +/– CT

Key questions to ask over the phone when being referred an inguinal hernia case which will make your time on-call easier:

1. Is the patient known to have an inguinal hernia?
2. *Have other differential diagnoses been ruled out?* Request CXR/AXR and urinalysis.
3. What were the findings on abdominal examination and has the hernia been reduced?
4. What were the blood results and has a VBG been done? Request if not yet performed.
5. Has the patient been cannulated and IV fluids or antibiotics started?
6. Is the patient exhibiting signs of peritonitis?

Taylor & Francis
Taylor & Francis Group
http://taylorandfrancis.com

Chapter 11
Bowel perforation

Tom Pampiglione

Bowel perforation is a surgical emergency that can occur as a complication of many different gastrointestinal (GI) conditions. The resulting leakage of bowel content causes contamination of the peritoneal cavity and subsequent sepsis.

Perforations can be broadly categorised as being free or contained. In free perforations, bowel contents are able to pass unobstructed into the peritoneal cavity. In contained perforations, there is still a full-thickness hole in the bowel wall, but the leakage is 'walled off' by adjacent structures (such as bowel) or the greater omentum.

The patient's response to a perforation will depend on the anatomical location. Perforation in the upper GI tract can lead to chemical peritonitis due to the leakage of acidic and enzymatic secretions. Lower GI perforations are more likely to cause bacterial peritonitis due to contamination by commensal gut flora.

GI perforation is usually secondary to an underlying condition. However, it can also be caused by iatrogenic injury, self-harm (ingestion of caustic substances or foreign bodies) or trauma (both blunt and penetrating). Upper GI causes are usually gastric or duodenal perforation secondary to peptic ulcer disease, although small bowel internal herniation can perforate due to the resultant bowel ischaemia. Lower GI causes include acute appendicitis, diverticulitis, mesenteric ischaemia, inflammatory bowel disease and volvulus. Malignancy can cause perforation at any point along the GI tract.

When assessing a patient with suspected bowel perforation:

The key points to consider are:

- To resuscitate the patient appropriately, including broad-spectrum antibiotics.
- To assess how urgent the need for surgery is and know when to escalate quickly.
- To investigate the cause of the perforation.

History and examination

Bowel perforation is a surgical emergency and these patients should be approached in an ABCDE (airway, breathing, circulation, disability, exposure) manner (see Chapter 8).

The specific details to elicit are:

- Take a very detailed pain history.
  - What was the site of the pain?
  - Did the pain start suddenly?
  - Is the pain constant? Does it radiate anywhere?
  - What is the character of the pain and are there any associated symptoms?
  - How severe is the pain?
- Severe, constant upper abdominal pain that is worse on movement and breathing suggests perforation. The severe pain is usually of sudden onset but can be preceded by abdominal discomfort. A background of less severe upper abdominal pain suggests underlying pathology such an ulcer or malignancy.
- Has the patient ever had this pain before?
- Does the patient have any risk factors for perforation? These include:
  - Diverticulitis
  - Peptic ulcer disease
  - Use of NSAIDs (nonsteroidal anti-inflammatory drugs) or steroids
  - Malignancy (not just GI)
  - Any recent surgery or invasive procedure
  - Trauma
- Any constitutional symptoms that might suggest malignancy (weight loss, change in bowel habit, rectal bleeding and abdominal mass)?
- Ask about systemic symptoms that can give you an idea of how unwell the patient is. Have they been having fevers, chills or rigors?
- Any nausea, vomiting or distension? These may suggest outflow obstruction or volvulus.

As part of a full examination, focus on:

- How much pain does the patient appear to be in and what effect is it having on them? Lying flat and still suggests peritonitis, whereas rolling around in pain suggests colic.
- Check the patient's observations. Are they showing signs of systemic inflammatory response syndrome (SIRS)? (See Chapter 8 for SIRS criteria)

- Do they have local or generalised tenderness? Is there a rigid abdomen?
  - A tense, firm, 'washboard' abdomen is a sign of generalised peritonitis.
  - Pressure on any part of the abdomen will feel firm and cause pain.
- Are there any palpable masses?
- Is there abdominal distension?
  - Remember distension from free air in perforation is not always painful.
- When percussing the abdomen, pain on percussion suggests peritonitis and a tympanic note suggests free air or accompanying obstruction.
- Any bowel sounds present? Usually absent in peritonitis due to ileus.
- Perform a digital rectal examination:
  - Any blood?
  - Impacted stool?
  - Palpable mass?

Routine investigations

Routine bloods should be ordered, including:

- *FBC (full blood count) and CRP (C-reactive protein)*: Inflammatory markers are raised in perforation and sepsis. A low Hb may be an indicator that the patient is bleeding.

> **Tip:** The level of inflammatory markers should not be used as a guide to the severity of the perforation.

- *Renal function*: Check for signs of acute kidney injury or electrolyte imbalance to guide resuscitation. Raised urea may indicate GI bleeding.
- *Amylase*: To exclude pancreatitis as a cause of abdominal pain (see Chapter 14). Note that any significant intra-abdominal or retroperitoneal inflammation can produce a mildly elevated amylase level.
- *Venous or arterial blood gas*: Check for acidosis and raised lactate.
- *Group and screen with clotting*: Patients who have perforated are unstable. Ensuring you have a valid group and screen early will be useful if the patient requires an urgent blood transfusion or needs to go to theatre.

- *Urinalysis*
  - To rule out pregnancy in women of child-bearing age.
  - A urinary tract infection may mimic a lower GI perforation so it is important to rule one out.
- *Erect chest X-ray (CXR)*
  - Ensure the patient has been sitting up for at least 10 minutes prior to the radiograph being taken.
  - Is there free air under the diaphragm (see Figure 11.1)?
    - Air is most commonly seen under the right haemidiaphragm, above the liver. Remember a normal erect CXR does not exclude a perforated viscus. Only 70% of patients with a perforation have free air on erect CXR.
- *Abdominal X-ray (AXR)*
  - This will help you diagnose the cause of the suspected perforation. Look for dilated bowel loops, faecal impaction or a volvulus (seen on X-ray as a large, dilated loop of the colon)
  - Look for Rigler's sign. This is where both sides of the bowel wall are visible due to free air in the abdomen. Large volumes of air (>1 L) are required for this to be seen (see Figure 11.1).
  - It is important to remember, however, that AXR can also be normal in bowel perforation.

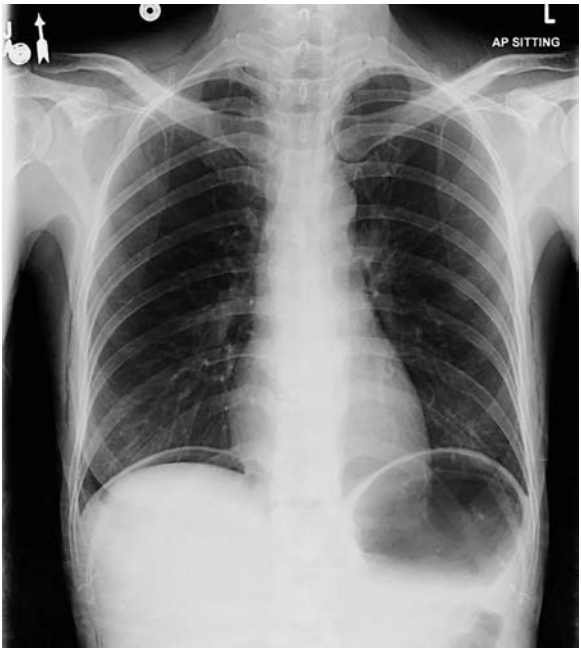


Figure 11.1 Chest X-ray showing pneumoperitoneum.

- *ECG (electrocardiogram)*
  - Myocardial infarction can present as upper abdominal pain and must be ruled out.
  - This will also be required for the pre-operative workup.

Specialist investigations following discussion with seniors

- CT abdomen and pelvis (CT AP) with contrast
  - This is the gold-standard investigation for bowel perforation and can be performed with or without oral contrast (Gastrografin).
  - Check the renal function for IV (intravenous) contrast.
  - Ensure that your patient is well enough to transfer to the CT scanner.
  - If they are unstable, they may require immediate surgery without imaging.

Specific scenarios follow

A patient presents with sudden onset of upper abdominal pain in the last 2 hours with a history of long-term ibuprofen use due to lower back pain. They have raised inflammatory markers and there is free air under the diaphragm on erect CXR.

It is likely that this patient has a perforated peptic ulcer in the stomach or duodenum and will require an operation. These are most frequently caused by infection with *Helicobacter pylori* and NSAIDs.

- Start fluid resuscitation, give a stat dose of IV PPI (proton-pump inhibitor) (40 mg omeprazole OD) and empirical IV antibiotic therapy (as per hospital policy, such as IV co-amoxiclav 1.2 g TDS if no penicillin allergy) before getting early senior involvement.
- Insert a urinary catheter and monitor fluid balance.
- Keep the patient nil-by-mouth and consider nasogastric tube (NGT).
- Since the patient is stable, discuss with your senior before getting a CT AP.
- Give the patient analgesia (IV morphine 5–10 mg titrated to response) and anti-emetics (e.g. IV cyclizine 50 mg).

Small and contained perforations may occasionally be managed conservatively, however, most patients will require an operation. Laparoscopy or laparotomy with omental patch closure of the perforation site may be performed. Alternatively, resection may be required if there is a large perforation or cancer is suspected.

If your seniors have decided that the patient will require surgery, it is important to make them ready for theatre:

- Follow the local procedures for booking the emergency theatre.
- Discuss the patient with the theatre coordinator and on-call anaesthetic registrar.
- Ensure that your patient has been consented (by an appropriate member of the surgical team), has an ECG and valid clotting, and group and save.
- Give a good handover to the ward or emergency department nurses to ensure there is no delay when theatres send for the patient.
- Update the patient (and relatives if appropriate) on the current findings and surgical plan until a senior is available to consent them for surgery.

Following surgery, it is important to address the underlying cause of ulceration. For example, this may be *H. pylori* eradication (see Chapter 8), cessation of NSAIDs or changes to diet. Patients are usually discharged from hospital with a course of PPI therapy (e.g. omeprazole 40 mg OD for 6 weeks). They will require an outpatient OGD (oesophagogastroscopy) around 6 weeks after discharge to ensure the ulcer has healed and exclude any associated malignancy.

Key questions to ask over the phone when being referred an upper GI perforation case which will make your time on-call easier:

1. Any known peptic ulcer disease, upper GI cancer, recent surgery or ITU (intensive treatment unit) stay?
2. Any history of NSAID or steroid use?
3. What are their observations? Are they stable? Are they in resus?
4. What are the findings of the abdominal examination, including PR?
5. What are the findings of the CXR?
6. What are the findings of the blood tests, including the lactate?
7. Has the patient been cannulated and have IV antibiotics and fluids been started?

A 78-year-old patient with a history of diverticular disease presents with lower abdominal pain, peritonitis, pyrexia, tachycardia and hypotension.

This patient most likely has a perforated diverticulum and is showing signs of sepsis and haemodynamic instability. They require immediate

resuscitation and you should fast bleep your registrar to see them urgently.

- Start fluid resuscitation and empirical IV antibiotic therapy (as per hospital policy, such as IV co-amoxiclav 1.2 g TDS). Give adequate IV analgesia and anti-emetics.
- Take bloods and send off an urgent group and save.
- Monitor fluid balance with a urinary catheter.
- Keep the patient nil-by-mouth and insert an NGT.
- Ensure an ECG is performed for pre-operative workup.

If your patient does not respond to initial resuscitation then they may require an urgent laparotomy. You should prepare them for theatre.

Oesophageal perforation

Perforation can occur anywhere along the oesophagus but the most vulnerable parts are the three sites of anatomical narrowing – the cricopharyngeus, the broncho-aortic constriction and the gastroesophageal junction. Although oesophageal perforation is rare, it has potentially catastrophic consequences – leakage of gastric contents causes mediastinitis, resulting in severe inflammation, infection and multi-organ failure.

It is a surgical emergency and if encountered whilst on-call, the patient must be stabilised and prepared for treatment in a specialist centre. There are a number of potential causes (listed in order of decreasing frequency):

- >50% iatrogenic, majority endoscopic
- *Spontaneous*: Boerhaave's syndrome
- Foreign body ingestion
- Traumatic, including acid/alkali ingestion
- Malignancy

History and examination

The specific details to elicit are:

- Characterise the pain, it can present in a variety of different ways including chest pain or upper abdominal pain. This can lead to it being misdiagnosed as myocardial infarction/pneumonia/peptic ulcer disease.

- Establish the risk of iatrogenic injury (e.g. recent endoscopy/surgery).
- Establish if there are features of malignancy.

Patients with oesophageal perforation should be examined and managed in an ABCDE manner.

Specific scenarios

A patient with severe vomiting suddenly develops severe chest pain. He is haemodynamically unstable.

Any patient with suspected perforated oesophagus should be treated with an ABCDE approach to resuscitation, ideally in A&E (accident and emergency) resus with appropriate support from nursing and senior medical staff.

- ABCDE approach.
- Apply oxygen and establish wide-bore IV access.
- Send bloods for FBC, U&E (urea and electrolyte), LFT (liver function tests), CRP, clotting, group and save.
- Monitor HR (heart rate), BP (blood pressure), temperature, urine output (catheterise the patient).
- Give crystalloid fluids as appropriate, given haemodynamic stability of patient and predilection to fluid overload.
- Ensure patient is nil-by-mouth and insert a Ryles tube.
- Give broad-spectrum intravenous antibiotics to cover anaerobes and aerobes as per trust guidelines e.g. IV co-amoxiclav 1.2 g TDS.
- *Antifungal cover*: IV fluconazole 400 mg OD.
- Commence acid-suppression therapy e.g. omeprazole 40 mg IV BD.
- Request an erect CXR. There is usually an associated pleural effusion (sometimes bilateral) that requires drainage.
- Urgent ITU input.
- After discussion with a senior, a CT neck/chest/abdomen/pelvis should be ordered, usually with water-soluble oral contrast. Alternatively your senior may prefer a water-soluble contrast barium swallow to confirm the leak.

These patients may require surgery, which is generally performed at a specialist thoracic UGI (upper gastrointestinal) centre and they should always be discussed with your relevant tertiary referral unit. Intervention

may involve stenting or thoracotomy. Transfer should not occur until the patient has been correctly resuscitated and stabilised. Liaise with ITU beforehand.

Key questions to ask over the phone when being referred an oesophageal perforation case which will make your time on-call easier:

1. Any history of recent endoscopy, surgery, malignancy or trauma?
2. ECG findings? Has a troponin been sent (do not delay assessment or management waiting for these)?
3. What are the findings of the CXR?
4. What are the findings of the blood tests, including the lactate?
5. Has the patient been cannulated and have IV antibiotics and fluids been started?

A patient presents with a less common perforation not previously mentioned.

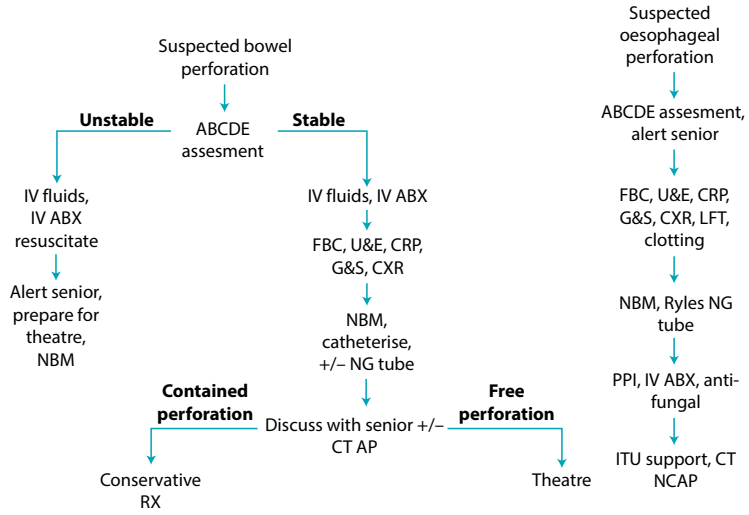
There are a number of other perforations that you should be aware of and should manage using the same principles as previously discussed.

- *Jejunal or ileal perforation*: Small bowel perforations in the absence of trauma are uncommon. The most common causes are iatrogenic, tumours or Crohn's disease. Rarely, perforation can be secondary to infection such as tuberculosis (TB) or typhoid. Treatment is usually resection of the perforated segment, although occasionally the bowel wall can be repaired primarily.
- *Rectal perforation*: Rectal perforation is very uncommon. It usually occurs secondary to instrumentation or tumour. Management relies on treating the underlying cause. Since the rectum is mostly retroperitoneal, free air is not seen in the abdomen and the patient is somewhat protected from generalised peritonitis. However, rectal perforations often result in complex pelvic collections and perineal wounds. Patients in this group should be managed in a specialist colorectal centre.

Natural sequelae

Contained perforations that have been managed conservatively will eventually resolve with IV antibiotics and fluids. Small, contained collections that are not resolving may require percutaneous drainage under interventional radiology. Large lower GI perforations with faeculent contamination or secondary to cancer will usually require a resection and stoma formation.

Summary algorithm



Key questions to ask over the phone when being referred a patient with a suspected bowel perforation:

1. Does the patient have any past medical history that makes perforation more likely?
2. What are the observations? Is the patient haemodynamically stable?
3. What were the abdominal examination findings? Is there generalised peritonitis?
4. What were the blood results? (request a VBG [venous blood gas]and group and save if not done).
5. What did the erect CXR show?
6. Has the patient been cannulated and IV fluids ± antibiotics given?

Chapter 12
Acute mesenteric ischaemia

Urpinder S. Grewal

Mesenteric ischaemia describes a group of disorders characterised by a symptomatic reduction in blood supply to the GI (gastrointestinal) tract. Mesenteric ischaemia can be acute or chronic. This chapter concentrates on acute mesenteric ischaemia (AMI) as you are unlikely to encounter chronic ischaemia during your on-call and this can be managed by vascular surgeons on an outpatient basis.

AMI may be divided depending on whether it is arterial or venous in origin:

- Acute arterial occlusion (atrial fibrillation [AF], valvular heart disease, myocardial infarction; 50% of cases).
- Non-occlusive arterial disease (low cardiac output state in critically unwell patients; 20% of cases).
- Venous thrombosis (<10% of cases).

In AMI, prolonged underperfusion of the gut leads to breakdown of the gut mucosal barrier, resulting in bacterial translocation with subsequent sepsis, multi-organ failure and death. The patient population with AMI tends to have multiple co-morbidities due to advanced age and shared risk factors for ischaemic heart disease and peripheral vascular disease. The mortality rate in AMI, therefore, is high (>60%), making prompt diagnosis and management crucial.

The patient's symptoms are usually disproportionate to the clinical findings and peritonism is a late finding, so you should have a high index of suspicion in any patient you are called to see with significant abdominal pain, particularly if they have any risk factors.

The key points to consider when managing AMI are:

- To identify those at risk of AMI early.
- To resuscitate the patient urgently and swiftly provide your senior colleagues with the investigative results required to enable further management.

History and examination

The specific details to elicit are:

- The character of the abdominal pain. Sudden-onset, persistent, diffuse abdominal pain is the characteristic of AMI.
- Ask about a change in bowel habit. Patients may describe episodes of diarrhoea or a rapid, forceful bowel evacuation, possibly containing blood.
- In older patients, identify common risk factors such as cardiovascular disease, history of emboli or arrhythmias.
- AMI is rare in younger patients but should be considered if the patient has risk factors such as a hypercoagulable state or the use of vasoactive medicines (inotropes such as noradrenaline or metaraminol) or cocaine.
- *History of previous abdominal surgery*: Multiple previous operations increase the risk of adhesions and difficulty/morbidity of surgical intervention. Previous surgery has also been linked with an increased risk of mesenteric venous thrombosis.
- Have they had any previous investigations, such as flexible sigmoidoscopy? When were they performed and what were the findings?
- Are there symptoms to suggest sepsis, such as fever or vomiting?
- *When did they last eat or drink?*: This is important as the patient may require prompt surgical intervention.

As part of a full examination focus on:

- Is there evidence of hypovolaemic shock?
- Is the patient showing signs of sepsis?
- Abdominal distension, marked tenderness and abdominal bruit are the most common features on abdominal examination.
- Is there generalised peritonitis? This is a late and worrying sign.

Routine investigations

Routine bloods should be ordered, including:

- *FBC (full blood count) and CRP (C-reactive protein)*: If the patient is bleeding, a haemoglobin level will be vital to assess severity of bleeding and guide the need for blood transfusions. On admission, approximately 75% of patients with AMI have a leukocytosis $>15 \times 10^9$/L cells.
- *Renal function*: Will be required if a CT (computerised tomography) abdomen and pelvis scan with contrast is ordered, although this may

be performed in the emergency setting before the result is back, so please request as urgent. Electrolyte imbalances and renal dysfunction are frequently present in these patients.

- *Group and screen with clotting*: If the patient requires surgery, these will be required as part of the pre-operative workup. A deranged clotting result will need to be corrected if the patient has a coagulopathy.
- *Arterial/venous blood gas*: On admission, approximately 50% of patients with AMI have metabolic acidosis and raised lactate. The degree of acidosis and response to fluid resuscitation also assists in determining the severity of the patient's condition.
- *Erect chest X-ray*
  - To look for air under the diaphragm in the event that AMI is complicated by perforation.
- *Abdominal X-ray*
  - The major role of abdominal X-ray is to exclude other causes of acute abdominal pain.
  - May demonstrate 'thumbprinting' of oedematous bowel wall, however, this is a late sign seen in only 40% of patients with AMI.
- *ECG (electrocardiogram)*
  - Will be useful for the anaesthetist when working the patient up for theatre.
  - May demonstrate arrhythmias (e.g. AF) or acute infarction that may be the aetiology of intestinal ischaemia.
  - If a concurrent acute coronary syndrome (ACS) is suggested based on symptoms and ECG, in most cases of ACS the management of the bowel ischaemia would take precedence; discuss this with the on-call cardiology SpR (specialist registrar).
  - In the case of a STEMI (ST-elevation myocardial infarction), this would require urgent discussion with the on-call cardiology SpR. They may suggest initiating some therapy whilst balancing this risk in someone who may require emergency laparotomy. Inform your senior immediately in this scenario so that a consensus on management can be achieved in a timely manner.

Further investigations following discussion with seniors

- CT abdomen and pelvis (CT AP)/CT angiogram (CT-A)
  - CT AP is ideally performed with contrast (where kidney function is normal).

- Contrast enhanced CT-A, whilst not gold standard, is the investigation of choice with AMI because it has a sensitivity >90% and is less invasive than mesenteric angiography.

- Mesenteric angiography
  - Whilst being historically the gold-standard test, it is now being replaced by CT-A. This is due to the invasive nature of the procedure, increased risk of complications and ease of performing CT-A. Mesenteric angiography, however, has the benefit of being potentially therapeutic as well as diagnostic.

Specific scenarios

A 72-year-old male is referred from the emergency department with sudden onset of severe abdominal pain. His medical history includes type 2 diabetes, hypertension and AF. He is not taking any anticoagulant medication. A&E (accident and emergency) specialists have found marked, diffuse abdominal tenderness despite analgesia.

The patient's history of AF in combination with abdominal pain should make AMI top of your differential list. Patients with AMI often become profoundly unwell, quickly entering into a state of shock and/or sepsis. Although definitive management will be senior-led, it is critical that you treat these patients aggressively from point of identification.

As part of an ABCDE (airway, breathing, circulation, disability, exposure) led treatment algorithm:

- Administer high-flow oxygen.
- Ensure adequate analgesia.
- 2x wide-bore intravenous (IV) access for aggressive fluid resuscitation.
- Aggressive fluid resuscitation to maintain a systolic BP >90 mmHg and urine output >0.5 mL/kg/hour.
- Commence IV empirical antibiotics as per trust guidelines, e.g. co-amoxiclav 1.2 g TDS due to the high risk of sepsis (if not penicillin allergic).
- Insert a catheter if signs of sepsis or concerns about fluid balance observed; commence hourly input/output fluid chart.
- Request initial investigations as outlined previously.
- If febrile, ensure a full septic screen is completed prior to the administration of antibiotics.
- Ensure early senior involvement. Alert escalation teams such as critical care outreach and ITU (intensive treatment unit)/HDU (high-dependency unit).

- Keep nil-by-mouth in case they need to go to theatre.
- Organise an urgent CT-A or CT AP (after senior discussion), unless they are too unwell to be safely transferred to the CT scanner.

Further management will likely be dependent on the results of imaging. However, if the patient is too unwell to be transferred to a scanner, a decision based on clinical findings will be made by a senior colleague. If there are signs of generalised peritonitis or perforation, the patient will likely require an emergency laparotomy to assess bowel viability and remove any gangrenous segments.

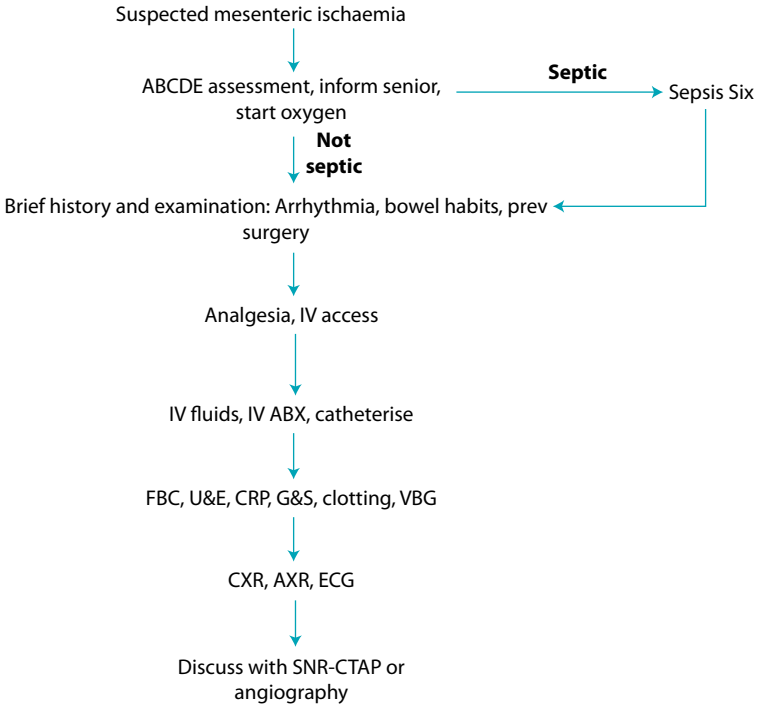
If bowel ischaemia is identified intraoperatively, local surgical expertise will determine the exact nature of surgery performed. Resection of gangrenous segments is essential, although primary anastomosis is usually not performed due to the risk of anastomotic breakdown and evolving bowel ischaemia. Bowel ends are often stapled closed (a linear stapling device is used to quickly seal and divide a segment of bowel) and left in the abdomen (which is either temporarily closed or left open – known as a laparostomy, where exposed abdominal contents are protected by a temporary dressing) and the patient is taken to ITU for ongoing resuscitation. Once the patient has been stabilised they are brought back to theatre around 24–48 hours later with a view to anastomosis or stoma formation during the second laparotomy. Depending on the site and nature of the arterial or venous occlusion and local expertise, embolectomy or thromboembolectomy may also be performed.

In the absence of infarction, perforation or peritonitis requiring urgent surgical intervention, consideration can be given to thrombolysis or angioplasty. The use of medical therapy such as intra-arterial vasodilators (papaverine) and heparinisation will widely vary in surgical centres, and will be initiated if required by the managing consultant/senior registrar. The patient's co-morbidities and pre-morbid/performance status are important factors in determining the appropriateness of intervention. If surgery is deemed futile by your seniors, then the decision may be made for palliation and comfort measures only.

Natural sequelae

As previously discussed, mortality in patients being treated for AMI is extremely high (>60%). For those who survive, there are extensive possible complications related to the management options implemented. It is therefore critical that regular reviews occur to identify possible complications at an early stage.

Summary algorithm


Suspected mesenteric ischaemia
ABCDE assessment, inform senior, start oxygen
Septic
Sepsis Six
Not septic
Brief history and examination: Arrhythmia, bowel habits, prev surgery
Analgesia, IV access
IV fluids, IV ABX, catheterise
FBC, U&E, CRP, G&S, clotting, VBG
CXR, AXR, ECG
Discuss with SNR-CTAP or angiography

Key questions to ask over the phone when being referred an AMI case which will make your time on-call easier:

1. Is the patient haemodynamically stable?
2. Have other differential diagnoses been considered?
3. What were the findings on abdominal examination?
4. What were the blood results? (Request they be performed if not yet done.) Lactate and arterial blood gas are of critical importance.
5. Has the patient been cannulated and IV fluids or antibiotics started?
6. Is the patient exhibiting signs of sepsis and/or shock?

Part III

Abdominal Viscera

Taylor & Francis
Taylor & Francis Group
http://taylorandfrancis.com

Chapter 13
Gallstone disease

Amelia Davidson

Gallstones represent a major health problem, with 70,000 cholecystectomies performed in the UK every year. About 25% of patients with gallstones will develop secondary complications, the most common being biliary colic, acute and chronic cholecystitis and acute pancreatitis.

The gallbladder lies in a fossa separating the right and quadrate lobes of the liver and acts as a bile concentrator and reservoir. Bile from the gallbladder drains into the cystic duct, which drains into the common bile duct (CBD). This terminates in the distal portion of the pancreatic duct, where contents are released into the second part of the duodenum (see Figure 13.1 and Chapter 15 for more detail).

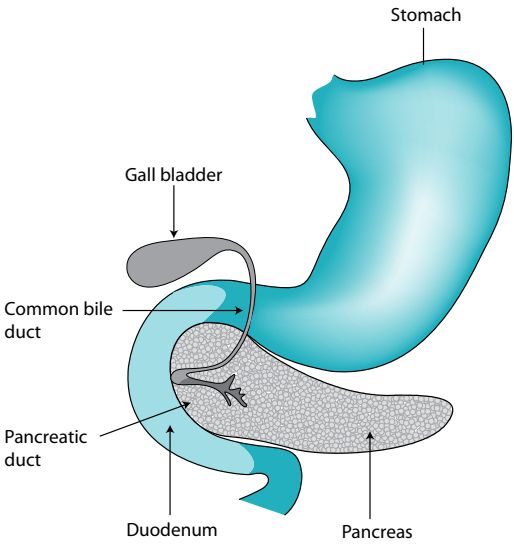


Figure 13.1 Anatomy of pancreato-biliary system.

The key points to consider in gallstone disease admissions are:

- To determine the need for admission based on the severity of symptoms and presence of sepsis. Simple biliary colic can be managed in the community.
- To assess urgently for signs of biliary sepsis and treat empirically with intra-venous antibiotics, IV (intravenous) fluids and arrange biliary drainage procedures with senior input.

History and examination

The specific details to elicit are:

- Is the pain colicky in nature, increasing gradually and reaching a plateau before settling (biliary colic) or is it a sharp, sudden pain that has lasted >6 hours (more likely cholecystitis)?
- Enquire about the presence of pale stools and dark urine. This is typical of obstructive jaundice.
- Are there features to suggest sepsis such as fever, vomiting or confusion?
- Assess for risk factors including hyperlipidaemia, diabetes, pregnancy, drugs (e.g. ceftriaxone and thiazide diuretics), inflammatory bowel disease and family history.
- Has the patient had any previous episodes, admissions or complications? This includes recent cholecystectomy or known CBD stones.
- Any prior investigations such as an ultrasound (US) abdomen, magnetic resonance cholangiopancreatography (MRCP), endoscopic retrograde cholangiopancreatography (ERCP) or CT AP (CT abdomen and pelvis)?
- Any constitutional symptoms to suggest hepatobiliary malignancy? These include weight loss, jaundice, anorexia, fatigue, rapid progression of symptoms and bony pain or back pain.

As part of a full examination focus on:

- Does the patient have any risk factors for cholesterol gallstones (female sex, Caucasian, obesity, >40 years, pre-menopausal)?
- Is the patient jaundiced? If so, you need to consider biliary obstruction.
- Does the patient have a positive Murphy's sign? Pain is elicited on palpation of the right subcostal area during inspiration (and absent on the left).

- **Positive in:…. Cholecystitis**
  - Cholecystitis is inflammation of the gallbladder secondary to blockage of the cystic duct with a gallstone, polyp or biliary sludge, or secondary to biliary stasis of any other cause. When the patient takes a breath, their inflamed gallbladder descends towards the examiners fingers, which irritates the peritoneum and causes abrupt pain.
- **Negative in:…. Ascending Cholangitis**
  - Cholangitis is a bacterial infection secondary to obstruction of the biliary tree by a gallstone, stricture or neoplasm. Patients typically have diffuse right upper quadrant (RUQ) pain rather than pain elicited by any particular manoeuvre. Charcot's triad of fever, RUQ pain and jaundice in cholangitis should be remembered.

- Is there a palpable gallbladder? An enlarged gallbladder, which is non-tender and accompanied by jaundice, is unlikely to be due to gallstones and points to cancer of the head of the pancreas or cholangiocarcinoma causing biliary obstruction (Courvoisier's law). Is the patient haemodynamically unstable and exhibiting signs of septic shock?
- Elderly patients may not exhibit classical signs and symptoms, and require a higher index of suspicion to avoid missing the diagnosis.

Routine investigations

Routine bloods should be ordered including:

- *FBC (full blood count) and CRP (C-reactive protein)*: WBC and CRP will confirm the presence of infection and help assess severity.
- *Renal function*: Will be required if a CT AP with contrast is ordered.
- *LFTs (liver function tests)*: Abnormal LFTs are common and may show a cholestatic picture, with a disproportionately raised alkaline phosphatase (ALP) and bilirubin.
- *Amylase/lipase*: A gallstone can migrate and lodge in the distal CBD or pancreatic duct, causing pancreatitis.
- *Coagulation screen with INR (international normalized ratio)*: A clotting profile is required if patients are undergoing ERCP and have a raised bilirubin, are on anticoagulation therapy or have a known clotting disorder.
- *Blood cultures*
  - Sepsis secondary to ascending cholangitis is usually caused by Gram-negative bacilli (*Escherichia coli*, *Klebsiella* and *Enterobacter*) or Gram-positive cocci (*Enterococcus*).

- *Venous blood gas*
  - Important in unwell patients to assess the acid/base balance, lactate level and monitor response to treatment.
- *Erect chest X-ray (CXR)*
  - To rule out a chest infection (right lower lobe pneumonia can cause RUQ pain).
  - To look for air under the diaphragm.
- *Abdominal X-ray (AXR)*
  - To look for pneumobilia (air in the bile duct, signifying sphincter of Oddi incompetence, biliary-enteric fistula or infection).
  - To look for biliary stents or clips from a previous cholecystectomy.
  - To look for dilated small bowel loops and calcified mass in the right iliac fossa (gallstone ileus).

Tip: 80% of gallstones are radiolucent on AXR and will therefore NOT be seen.

- *ECG (electrocardiogram)*
  - Will be useful for the anaesthetist when working the patient up for theatre.
  - Will help rule out an acute coronary syndrome (ACS) as a cause of upper abdominal pain.

Specialist investigations following discussion with seniors

- Abdominal USS
  - This is the diagnostic gold standard.
  - US findings include gallbladder distension (>4 cm), thick-walled gallbladder (>3 mm), CBD dilatation (>7 mm), peri-cholecystic fluid, gallstones and sonographic Murphy's sign (maximal tenderness from pressure of US probe over gallbladder).

Tip: Most centres are unable to perform USSs overnight, however, ensure you still request the scan so it will be top of the pile to be vetted in the morning.

- MRCP
  - MRCP is a non-invasive way to visualise the biliary tree and pancreatic duct. It is recommended when US is negative but either the bile duct is dilated or the LFTs are abnormal. This may be requested on an outpatient basis as guided by your seniors.

- ERCP
  - ERCP uses a combination of endoscopy (a camera is put down the oesophagus to the ampulla of Vater in the second part of the duodenum) and fluoroscopic imaging to diagnose and treat gallstones in the biliary system following cannulation of the CBD. It is usually preformed under sedation.
  - Complications of ERCP include post-ERCP pancreatitis (3%), duodenal perforation and gastrointestinal haemorrhage (see Chapter 15).
- CT abdomen and pelvis (with contrast)
  - This is reserved for patients who are critically unwell and there are concerns about complications of gallstone disease (e.g. emphysematous gallbladder or gallbladder perforation) or patients in whom an alternative diagnosis is suspected.

Specific scenarios

A 45-year-old man with known gallstones presents with colicky RUQ pain after eating a fatty meal. His abdomen is non-tender and he is otherwise well, with normal blood results.

Once other causes of abdominal pain have been ruled out this patient can be safely diagnosed with biliary colic on clinical grounds. This should be confirmed with a routine OP US abdomen. He can be discharged and managed on an outpatient basis. You should counsel him on modifiable lifestyle changes including regular physical activity, a low-fat and high-fibre diet, smoking cessation, gradual rather than rapid weight loss and regular health checks including a fasting blood glucose and cholesterol levels at the GP's clinic. You can consider booking him for a routine cholecystectomy within 12 weeks if the USS confirms the diagnosis with normal biliary anatomy (discuss this with your senior).

A 39-year-old woman presented with RUQ pain for the last 2 days, associated with fever. She has raised inflammatory markers.

This patient has presented with typical signs of acute cholecystitis. It is useful to enquire about a history of biliary colic or previous gallstones.

- Admit the patient and give analgesia as appropriate.
- Start IV fluids and antibiotics (for example 1.2 g co-amoxiclav IV TDS or a combination of Cefuroxime 750 mg IV TDS and Metronidazole 500 mg IV TDS depending on local protocol).
- Request an urgent inpatient US abdomen and inform your seniors.
- Check that the LFTs and amylase are normal.

US will show a thick-walled gallbladder, peri-cholecystic fluid or a stone in the cystic duct or Hartmann's pouch. These patients can either be treated conservatively with antibiotics or with a cholecystectomy. This will usually only be performed within 72 hours of symptom onset, but can be performed safely up to 7 days and is termed a 'hot chole'. Otherwise, the patient will most likely be booked for a routine cholecystectomy within 12 weeks when symptoms and intra-abdominal inflammatory changes have settled. Your seniors will guide you on how they prefer to treat these patients in your hospital.

A patient with known gallstones presents with epigastric pain radiating to the back, raised amylase/inflammatory markers and deranged LFTs.

This patient has developed gallstone pancreatitis and should be assessed using an appropriate severity scoring system (Glasgow/Ranson/APACHE [acute physiology and chronic health evaluation] II – see Chapter 14) and resuscitated.

- Admit and start IV fluids, oxygen and analgesia. Catheterise and monitor fluid balance.
- These patients can deteriorate quickly so discuss the patient with your seniors and consider getting an ITU (intensive treatment unit) review.
- Request an US to confirm the diagnosis and exclude persistent biliary obstruction.

Urgent ERCP is indicated with severe pancreatitis and a dilated CBD or jaundice. Patients should generally have definitive management of their gallstones during the same hospital admission, or within 2 weeks of discharge.

A patient presents with RUQ pain associated with jaundice. They have raised inflammatory markers and a fever.

This patient has presented with Charcot's triad (fever, jaundice and RUQ pain) and ascending cholangitis must be ruled out. Charcot's triad is present in 70% of patients with ascending cholangitis. Reynolds' pentad includes septic shock and confusion. Bloods show raised inflammatory markers, obstructive jaundice and elevated lactate. US almost always shows biliary dilatation. Patients may already have a biliary stent in situ and this could potentially be blocked.

- Start IV antibiotics and fluids.
- Give appropriate analgesia and make the patient nil-by-mouth.
- Patients should be admitted for urgent ERCP and decompression of the CBD with sphincterotomy and gallstone extraction.
- Early ITU input is recommended (there is a 10% mortality with cholangitis).
- Inform your registrar early for anyone with suspected cholangitis.

Complications

Some patients will go on to develop complications of gallstones such as:

Post-cholecystectomy: The most common complications include bile leak (from cystic duct injury or clip slippage, CBD injury or missed accessory duct of Luschka leakage), haemorrhage (usually from the cystic artery), sub-hepatic abscess and retained ductal stones.

If a patient reports increasing pain, with or without jaundice, within 48 hours of a cholecystectomy you should assume bile leak until proven otherwise. This is managed emergently due to the risk of sepsis and biliary peritonitis with broad-spectrum antibiotics and endoscopic biliary stenting or a T tube. Inform the surgeon who performed the procedure as they may wish to take the patient back to theatre for re-look laparoscopy, washout and drain insertion. Early involvement of a specialist HPB (hepato-pancreato-biliary) unit may also be useful (see Chapter 15).

If a patient becomes hypotensive, tachycardic and shocked in the immediate post-operative period you should suspect haemorrhage and cross-match 4–6 units of blood, give a fluid challenge of 250–500 mL crystalloid, site a urinary catheter and inform your senior. Sub-hepatic abscesses often present in the days or weeks after surgery and, depending on their size, are managed with IV antibiotics as per hospital policy (e.g. Piperacillin/Tazobactam 4.5 g IV TDS) and CT (computerised tomography)-guided drainage.

Emphysematous cholecystitis: Characterised by secondary infection of the gallbladder with gas-forming organisms (e.g. Clostridium or *E. coli*). This is a rapidly progressive form of acute cholecystitis characterised by early gangrene, gallbladder perforation and high mortality. Diagnosis is confirmed on CT AP, therefore if suspected, start your patients urgently on broad-spectrum antibiotics (after blood cultures e.g. Piperacillin/Tazobactam 4.5 g IV TDS), IV fluids, and arrange an urgent CT AP as you inform your senior and the ITU registrar. Treatment either involves percutaneous gallbladder drainage (cholecystostomy) or surgery (cholecystectomy) depending on the situation.

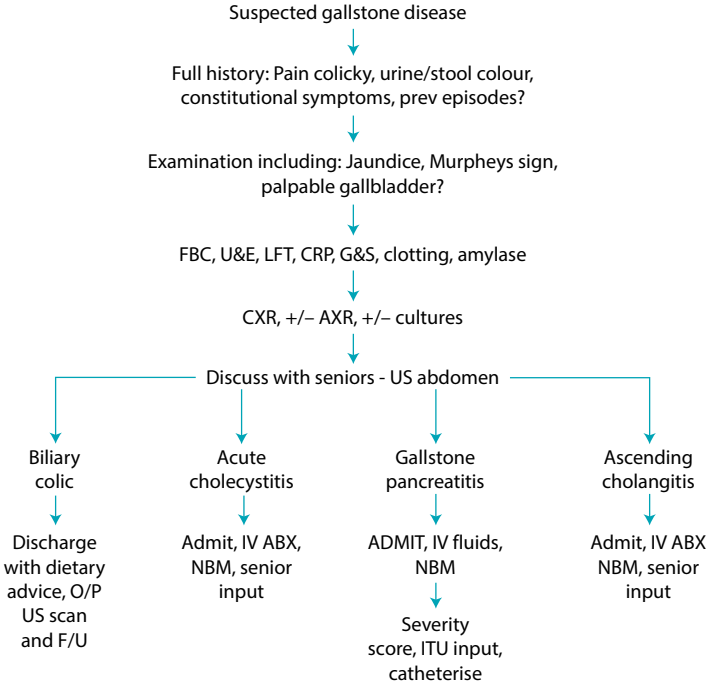
Cholecystoenteric fistula: Erosion of a stone through the gallbladder wall into the bowel, usually the duodenum. Can lead to gastric outlet obstruction (Bouveret's syndrome) or gallstone ileus if the stone passes along the small bowel to obstruct at the ileocaecal valve. If a patient presents with obstructive symptoms (distended

abdomen, vomiting, bowels not open with no flatus) on a background of abdominal surgery then site a wide-bore nasogastric tube, start IV fluids and arrange an erect CXR/AXR in the first instance (see Chapter 4).

Mirizzi's syndrome: An impacted gallstone in the gallbladder neck or cystic duct with extrinsic compression of the hepatic duct and obstructive jaundice. Suspect this in a patient with RUQ pain, obstructive jaundice and a tender palpable gallbladder (do not confuse with Courvoisier's law which states 'a palpable non-tender gallbladder in the presence of jaundice is unlikely to be due to gallstones'). When treating these patients ensure they receive IV fluids and analgesia. Start broad-spectrum antibiotics as for cholecystitis if the inflammatory markers are raised. The definitive investigation for this is an MRCP (although an US abdomen or CT AP may be requested first). Treatment involves an ERCP (± stent) or cholecystectomy (± bile duct reconstruction) in a tertiary HPB centre.

Porcelain gallbladder: Calcification of the gallbladder wall seen on abdominal plain films, associated with gallbladder cancer (around 20%). If you suspect this, an US or CT abdomen is recommended followed by specialist opinion and elective cholecystectomy.

Summary algorithm


Suspected gallstone disease
Full history: Pain colicky, urine/stool colour, constitutional symptoms, prev episodes?
Examination including: Jaundice, Murpheys sign, palpable gallbladder?
FBC, U&E, LFT, CRP, G&S, clotting, amylase
CXR, +/– AXR, +/– cultures
Discuss with seniors - US abdomen
Biliary colic
Discharge with dietary advice, O/P US scan and F/U
Acute cholecystitis
Admit, IV ABX, NBM, senior input
Gallstone pancreatitis
ADMIT, IV fluids, NBM
Severity score, ITU input, catheterise
Ascending cholangitis
Admit, IV ABX NBM, senior input

Key questions to ask over the phone when being referred a suspected gallstone case which will make your time on-call easier:

1. Is the patient jaundiced?
2. Does the patient have localised RUQ pain or generalised abdominal pain?
3. Are the LFT results back and, if so, what are the values? What is the amylase?
4. Does the patient have any previous USSs on the system or known gallstones?
5. If the referrer is suspected ascending cholangitis, have the critical care/ITU team been involved? Have they taken blood cultures and given antibiotics?

Taylor & Francis
Taylor & Francis Group
http://taylorandfrancis.com

Chapter 14
Acute pancreatitis

Robert Adams and Christopher Limb

The pancreas is a retroperitoneal organ lying behind the stomach at the level of the transpyloric plane (L1). It has exocrine function, aiding digestion through the production of lipase, amylase and trypsinogen, and endocrine function, in blood glucose regulation.

Acute pancreatitis is an inflammatory process characterised by triggered auto-digestion of the pancreas with subsequent systemic effects. It typically presents with severe abdominal pain radiating to the back, nausea and vomiting. Pancreatitis can be a severe and life-threatening condition, so early recognition and aggressive treatment are essential in its management.

The key points to consider in acute pancreatitis are:

- To manage with aggressive IV (intravenous) fluid resuscitation.
- To risk stratify patients, recognising those who will have severe pancreatitis and may require high dependency care.
- To investigate the underlying aetiology.
- To monitor response to treatment and recognise potential complications.

History and examination

Patients should initially be assessed and managed through a structured ABCDE (airway, breathing, circulation, disability, exposure) approach, before moving onto a more focussed history and examination.

The specific details to elicit are:

- Severity and characteristics of abdominal pain; including any radiation.
- Nausea and vomiting; including volume, frequency and colour.

- Bowel and urinary habits.
- Risk factors for pancreatitis (see 'GET SMASHED' text box below).
- Medication history including any recent changes.
- Past medical history including previous pancreatitis or gallstone disease.

GET SMASHED (causes of acute pancreatitis)

Gallstones (40%)

Ethanol (alcohol) (40%)

Trauma

Steroids

Mumps/malignancy

Autoimmune

Scorpion venom

Hyperlipidaemia/hypercalcaemia

ERCP (endoscopic retrograde cholangiopancreatography)

Drugs (e.g. azathioprine, sodium valproate, mesalazine, opiates, steroids, ACE (angiotensin-converting-enzyme) inhibitors, loop/thiazide diuretics).

Points to focus on during the examination are:

- Abdominal examination for signs of peritonitis.
- *Assess the patient's fluid status*: Look at their mucous membranes, urine output, capillary refill and skin turgor. Do they have warm peripheries?
- Review for indicators of systemic inflammatory response syndrome (SIRS – see Chapter 8 for definition).

Routine investigations

Routine bloods should be ordered including:

- *Amylase*: A diagnosis of pancreatitis is made when the amylase is *three times* the upper limit of normal. Be aware that on a background of chronic pancreatitis the amylase may be normal, this is due to ongoing impaired pancreatic function reducing the ability to produce amylase. In chronic pancreatitis clinical suspicion and CT (computerised tomography) abdomen are often required for diagnosis.
- *Full blood count* (FBC): WBC (white blood cells) for severity scoring.

- *Urea and electrolytes* (*U&E*): Urea for scoring and renal function to exclude AKI (acute kidney injury).
- *CRP* (*C-reactive protein*): Independent indicator of severity (>150 at 48 hours considered severe) and used to monitor for improvement.
- *LFTs* (*liver function tests*): ALT (alanine aminotransferase)/AST (aspartate aminotransferase) and albumin used in scoring and can indicate whether gallstones may be involved in aetiology.
- *LDH* (*lactate dehydrogenase*): For scoring.
- *Bone profile*: Calcium for scoring.
- *Coagulation screen*: INR (international normalized ratio) to assess hepatic function and in the anticipation of potential ERCP.
- *ABG* (*arterial blood gas*): For scoring and lactate as an indicator of severity and degree of shock.
- *Blood glucose*: For scoring.

As part of the workup for pancreatitis it is important to assess the severity using a validated scoring system, such as the Glasgow, Ranson or APACHE (acute physiology and chronic health evaluation) II scores.

The most commonly used system in the UK is the Glasgow score, giving a value between 0 and 8 (see blue box with Glasgow scoring system). A score of *3 or more* indicates severe pancreatitis and should prompt a referral to the Intensive Care or Outreach team to be aware of the patient and possible review.

It is important to request all appropriate investigations during the initial assessment and you will impress your seniors if you can provide this when you first present the patient to them. These patients are then re-scored at 48 hours.

Glasgow score for pancreatitis (remember pneumonic 'PANCREAS')

P – pO2 <8 kPa
A – Age >55 years
N – Neutrophils (WBC) >15 × 10^9/L
C – Calcium <2 mmol/L
R – Renal function (urea) >16 mmol/L
E – Enzymes – LDH >600 iU/L or AST/ALT >200 mmol/L
A – Albumin <32 g/L
S – Sugar (BM [Boehringer Mannheim]) >10 mmol/L

It is important to note that amylase does not indicate the severity of pancreatitis and is only used for diagnosis. If the level is not significantly raised, a diagnosis can still be made using imaging (CT).

- *Urinalysis*
  - To rule out urinary tract infection as a cause of the abdominal pain.
- *Erect chest X-ray*
  - Air under the diaphragm would indicate a perforated viscus.
  - Pleural effusion or diffuse lung changes can occur in severe pancreatitis, including acute respiratory distress syndrome (ARDS).
- *Abdominal X-ray*
  - Single dilated small bowel loop in the mid, upper abdomen, known as a 'sentinel loop', suggests pancreatitis (see Figure 14.1).
- *ECG (electrocardiogram)*
  - To help rule out acute coronary syndrome (ACS) as a cause of abdominal pain.

Figure 14.1 Abdominal AP (anteroposterior) radiograph showing a sentinel loop in acute pancreatitis. (Courtesy of Department of Radiology, Barts & The London NHS Trust – London.)

Specialist investigations following discussion with seniors

- Further blood tests
  - *Lipase*: More sensitive for pancreatitis than amylase but expensive and not available at all hospitals.
- Ultrasound abdomen
  - Can diagnose pancreatitis, but more importantly identifies possible gallstones as the underlying cause and any biliary dilation that may require further treatment.
- CT abdomen and pelvis (with contrast)
  - For diagnosis of pancreatitis (Balthazar criteria) and to rule out other differential diagnoses; in particular a perforated viscous. CT is only appropriate if the diagnosis is not clear or if the patient is not responding to initial conservative management and complications are suspected.

Balthazar grade is a description of the pancreatic appearance on CT as outlined below. This is combined with a score of 0–6 for the degree of pancreatic necrosis to give the CT Severity Index out of 10 points, allowing stratification into mild (0–3), moderate (4–6) and severe (7–10) pancreatitis that can guide the need for high dependency input.

A. *Normal pancreas*: 0 points

B. *Enlargement of pancreas*: 1 point

C. *Inflammatory changes in pancreas and peripancreatic fat*: 2 points

D. *Ill-defined single peripancreatic fluid collection*: 3 points

E. *Two or more poorly defined peripancreatic fluid collections*: 4 points

  - Necrotising pancreatitis is only visible on CT after 72 hours, so CT imaging is not usually requested until after 3 days.
- MRCP (magnetic resonance cholangiopancreatography)
  - Used when biliary or pancreatic duct obstruction is suspected with an inconclusive USS (ultrasound scan) for example in gallstone pathology with deranged LFTs.
- ERCP
  - Indicated in acute gallstone pancreatitis with persistent biliary obstruction or cholangitis, ideally within 72 hours. It should be used with caution due to the risks of the procedure, which could worsen the clinical situation and should only be requested following senior review.

Principles of initial management

Acute pancreatitis is a common condition seen when on-call and you are likely to be the person implementing the initial management of these patients before senior review. Patients with acute pancreatitis can deteriorate quickly and it is vital your initial management is effective. For this reason we have outlined some of the principles of initial management below.

Fluid balance:

- Aggressive approach to fluid resuscitation is essential in the initial management of pancreatitis. Current guidelines suggest 250–500 mL of isotonic crystalloid e.g. Hartmann's solution, should be administered per hour for 12–24 hours, being careful to consider renal or cardiac co-morbidities.
- A catheter should be inserted in severe pancreatitis.
- Fluid balance should be monitored carefully to guide ongoing fluid resuscitation.

Nutrition:

- Patients typically develop an ileus during the acute inflammatory phase. To reduce the risk of aspiration, initial advice should be for sips of water only.
- If persistent nausea or vomiting a NG (nasogastric) tube should be inserted.
- If the patient is unable to tolerate oral diet then nutrition should be provided by the enteral route (either NG or NJ [nasojejunal]) to protect the intestinal mucosal lining, preventing translocation of gut bacteria. TPN (total parental nutrition) is not contraindicated but has the additional risk of central line sepsis and should be avoided if possible.

Symptom control:

- Adequate analgesia should be prescribed according to the World Health Organisation (WHO) pain ladder (see text box below and visit http://www.who.int/cancer/palliative/painladder/en/ for more details). Both regular and as required analgesia should be prescribed.
- Prescribe a choice of anti-emetics in case one is ineffective, such as IV/IM cyclizine 50 mg TDS and IV/IM ondansetron 4 mg BD.

WHO analgesic ladder

1. Non-opioid (paracetamol 1 g QDS ± ibuprofen 400 mg TDS if renal function satisfactory and not contraindicated).
2. Weak opioid (codeine phosphate 30–60 mg QDS) + non-opioid (as above).
3. Strong opioid (oramorph 10–20 mg or SC/IM/IV morphine 5–10 mg every 2–4 hourly; or in severe pancreatitis a morphine/fentanyl PCA (patient-controlled analgesia) should be considered) + non-opioid (as above).

In practice often regular co-codamol (30/500 II QDS) is prescribed with PRN oramorph 10–20 mg and titrated by the nursing staff accordingly. NB: avoid co-prescribing paracetamol when the patient is taking co-codamol.

At each level of the pain ladder adjuvants should also be considered, such as amitriptyline 10 mg ON or gabapentin 75–150 mg BD, however these are more commonly reserved for chronic pancreatitis.

Risk stratification:

- Patients with a Glasgow score of 3 or more should be considered for high dependency care where they can be monitored more closely to prevent deterioration.
- These patients should receive early senior review and regular reassessment.

VTE (venous thromboembolism) prophylaxis:

- Pancreatitis is a systemic inflammatory condition so these patients will be at increased risk of VTE.
- Prescribe both thrombo-embolic-deterrent stockings and prophylactic dose low molecular weight heparin if not contraindicated.

Antibiotics:

- Antibiotics are not normally required in acute pancreatitis. Due to the evidence of a systemic inflammatory response, many mistakenly prescribe regular antibiotics, however, this should normally be avoided unless there is a clear source of infection.
- Antibiotics are indicated in necrotising pancreatitis that is not responding to conservative management after 7–10 days. The decision to start antibiotics should be taken by a senior member of the surgical team, often in consultation with a microbiologist.

Surgery:

- Surgery is rarely indicated in acute pancreatitis. Drainage of fluid collections can be achieved through percutaneous or endoscopic techniques.
- Necrosectomy (open or minimally invasive to remove necrotic peripancreatic tissue) is occasionally performed in specialist centres, usually after discussion with a tertiary HPB (hepato-pancreato-biliary) unit.

Specific scenarios

A 23-year-old man presents with severe epigastric pain, radiating to the back having consumed a large amount of alcohol the night before. His amylase is 500 and Glasgow score is 1 (WCC 16 $\times$ 10^9/L).

Based on the history and significant rise in amylase, a provisional diagnosis of acute pancreatitis can be made. This patient is scoring 1, which categorises them as having *mild pancreatitis* (80% of acute pancreatitis falls into this category). They are therefore likely suitable for ward-based care.

- Perform an ABCDE assessment.
- Make the patient nil-by-mouth and commence IV fluid resuscitation with fluid balance monitoring.
- Prescribe analgesia, according to the WHO analgesic ladder (see text box), and anti-emetics. Ondansetron 4 mg PO/IM/IV TDS is normally effective in pancreatitis.
- Perform an erect chest X-ray (CXR).

In pancreatitis, intravascular fluid losses to the third space warrant *aggressive fluid management* as early as possible. In a 70-kg young, healthy individual, with no major co-morbidities such as in this scenario, the following fluid regime would be appropriate:

1. 500 mL Hartmann's solution STAT (a fluid bolus).
2. 1000 mL Hartmann's solution given over 1 hour.
3. 1000 mL Hartmann's solution given over 2 hours.
4. 1000 mL Hartmann's solution given over 4 hours.
5. 1000 mL Hartmann's solution given over 8 hours.

Generally speaking 4–5 L of IV fluids should be administered within the first 12–24 hours of admission. This will of course be titrated appropriately according to regular fluid balance assessments, with particular care taken

to assess for signs of fluid overload (rising JVP [jugular venous pressure], peripheral oedema, pulmonary oedema).

A CT pancreas is not required in this particular patient at present. It would be reserved for cases in which the initial response to fluid resuscitation was poor, or if there was uncertainty surrounding the diagnosis. If in any doubt, seek advice from your registrar. An USS abdomen, however, is essential to exclude gallstones (in the first presentation), even though this is unlikely given the history.

The patient in this scenario will likely be discharged after 24–48 hours when their pain has resolved if they remain clinically well. All patients with a first admission of acute pancreatitis need to be followed up in 3–4 weeks for further investigation and education in an upper GI or HPB surgical outpatient clinic.

A 57-year-old man presents with severe epigastric pain, nausea, vomiting, and jaundice. His amylase is 1200 and his Glasgow score is calculated to be 5.

As in the scenario above, the ABCDE approach should be used with aggressive IV fluids and an erect CXR performed whilst the patient is still in A&E (accident and emergency) department (move them to resus and call your senior if they are unstable). This patient is scoring 5, which indicates *severe pancreatitis*. Inform ITU (intensive treatment unit) for review and admission.

- Start aggressive IV fluids, catheterise and monitor response.
- Get urgent senior surgical and ITU input in A&E resus.

Once the patient has been stabilised, an abdominal USS scan should be requested to assess for evidence of biliary duct dilatation or impacted gallstones.

If a gallstone blockage is proven on US ± MRCP, or if there is evidence of ascending cholangitis (abdominal pain, fever and jaundice) then an urgent ERCP should be undertaken. This is ideally carried out within 72 hours of admission. These patients should also have an elective laparoscopic cholecystectomy during the admission or within 2 weeks of discharge, unless complications develop, as they are at high risk of further attacks of severe pancreatitis (see Chapter 13).

Again, the use of antibiotics in these patients is debated. If there is any suspicion of ascending cholangitis or acute cholecystitis, or if the patient is septic, then IV broad-spectrum antibiotics (e.g. Piperacillin/Tazobactam 4.5 g TDS) should be started urgently according to local hospital policy. Antibiotics are not indicated in uncomplicated acute pancreatitis, but if in any doubt discuss the patient with your senior and the on-call microbiologist.

Natural sequelae

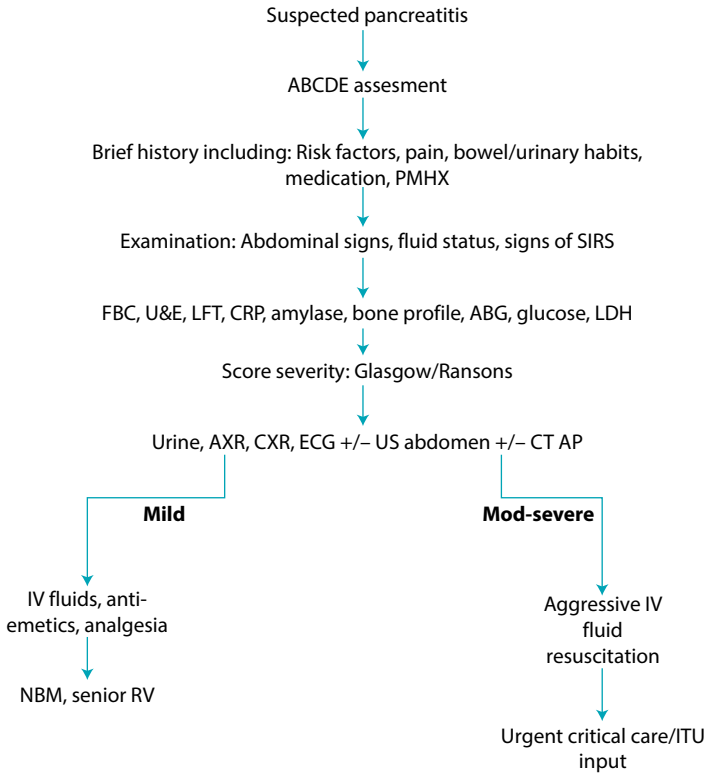
Most patients with acute pancreatitis respond well to conservative management. Complications of pancreatitis can be multi-system, which is why early involvement of high dependency care is essential. These include:

- Local necrosis, infection or haemorrhage
- Pseudocyst development
- ARDS
- Renal failure
- Disseminated intravascular coagulation (DIC)
- Multiple organ dysfunction syndrome (MODS)
- Death

Patients who are not responding to conservative management should have a CT pancreas at 72 hours and repeated as necessary during their illness to assess for local complications.

When an underlying cause has been found it should be managed appropriately. For example, patients with gallstone pancreatitis should have a laparoscopic cholecystectomy within 2 weeks of discharge. If no cause is found then the patient should be followed up in clinic for further investigations including bloods, further imaging and genetic testing. It is important to limit risk factors, as there is significant morbidity and mortality associated with each episode of pancreatitis.

Summary algorithm


Suspected pancreatitis
ABCDE assesment
Brief history including: Risk factors, pain, bowel/urinary habits, medication, PMHX
Examination: Abdominal signs, fluid status, signs of SIRS
FBC, U&E, LFT, CRP, amylase, bone profile, ABG, glucose, LDH
Score severity: Glasgow/Ransons
Urine, AXR, CXR, ECG +/– US abdomen +/– CT AP
Mild
Mod-severe
IV fluids, anti-emetics, analgesia
NBM, senior RV
Aggressive IV fluid resuscitation
Urgent critical care/ITU input

Key questions to ask over the phone when being referred a pancreatitis case which will make your time on-call easier:

1. Have other differential diagnoses been investigated for? Ask for an ECG and erect chest x-ray.
2. Have all scoring bloods been performed? FBC (WCC [white cell count]), U&E (urea), LFTs, bone profile (Ca^{2+}), LDH? Ensure an ABG has been done.
3. Has IV fluid resuscitation has been started? Is the patient catheterised?
4. Is the patient haemodynamically stable? Do they require transfer to resus?

Plan after diagnosis and scoring of acute pancreatitis:

- *Mild*: Start IV fluids, analgesia, anti-emetic.

  Make patient nil-by-mouth.
  Request an abdominal USS to investigate for gallstones.

- *Severe*: Start aggressive resuscitation with IV fluids.

  Urgent critical care and senior input.

Chapter 15
Hepatobiliary and pancreatic emergencies

Thomas Clifford

This chapter deals with emergencies arising from pathology within the hepat-pancreato-biliary (HPB) system. Knowledge of the relevant anatomy of this area is integral to correctly diagnosing HPB emergencies and understanding the rationale for the various management options available.

Gallbladder

The gallbladder is a hollow organ that sits in the gallbladder fossa on the inferior surface of the right lobe of the liver. It has a fundus, body and neck, which is continuous with the cystic duct. At the junction between the neck and the cystic duct there is an out-pouching, known as Hartmann's pouch, which is a common site of impaction for gallstones. Its function is to store bile for release when a fatty meal is eaten. When fat enters the duodenum it stimulates the release of cholecystokinin, which in turn stimulates the gallbladder to contract (see Chapter 13).

Biliary tree

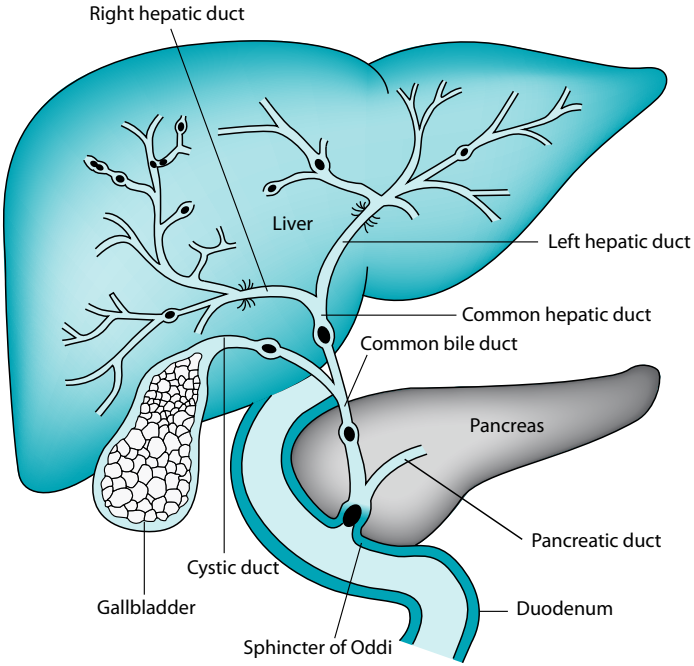
Bile drains from the liver via the left and right hepatic ducts, which unite to form the common hepatic duct. The cystic duct then joins the common hepatic duct to form the common bile duct (CBD). The CBD enters the head of the pancreas and unites with the main pancreatic duct to form the ampulla of Vater, a short duct that opens into the second part of the duodenum. This opening is known as the major duodenal papilla and is surrounded by a ring of smooth muscle called the sphincter of Oddi. When the sphincter is open bile can drain freely into the duodenum, when it is closed bile backs up and enters the gallbladder where it is stored until it is required.

Pancreas

The pancreas is a retroperitoneal organ sited posterior to the stomach. It has a head, uncinate process, body and tail. It functions as an endocrine gland, releasing hormones including insulin and glucagon into the bloodstream, and an exocrine gland, releasing pancreatic fluid into the duodenum via the pancreatic duct and ampulla of Vater.

With an understanding of the anatomy it becomes clear that:

- A blockage in the hepatic ducts has the potential to cause problems in the liver.
- A blockage in the gallbladder or cystic duct has the potential to cause problems in the gallbladder.
- A blockage in the CBD has the potential to cause problems in the biliary tree, gallbladder and liver.
- A blockage in the ampulla of Vater has the potential to cause problems in the biliary tree, gallbladder, liver and pancreas.



Gallstone-related HPB emergencies are covered in-depth in Chapter 13. This chapter covers non-gallstone-related HPB emergencies, however the history, examination and investigations you should carry out will be similar to gallstone disease and you should read that chapter in conjunction with this one.

The key points to consider when dealing with HPB emergencies are:

- To assess the patient in an ABCDE (airway, breathing, circulation, disability, exposure) manner and resuscitate them using advanced life support (ALS)/care of the critically ill surgical patient (CCrISP) guidelines (see Chapter 8).
- To correctly diagnose the source of the problem using relevant investigations and anatomical knowledge.
- To start appropriate management and escalate to seniors as necessary.

Acalculous cholecystitis

Acalculous cholecystitis is inflammation of the gallbladder in the absence of gallstones, representing approximately 5%–10% of cases of cholecystitis. As with calculous cholecystitis the condition occurs due to bile stasis, however it is due to decreased gallbladder motility rather than obstruction. It typically affects patients with sepsis, in intensive care units or on long-term total parenteral nutrition (TPN) and is more common in patients with diabetes.

History and examination

As it usually occurs in critically ill patients, the presentation is markedly different than calculous cholecystitis and patients will often be unable to communicate their symptoms. This can make diagnosis challenging and it should be suspected in any immunocompromised, critically ill or injured patient who develops sepsis with no clear source.

See Chapter 13 for guidance on specific questions to ask and key parts of the examination.

Routine investigations

Routine bloods should be ordered including:

- FBC (full blood count), U&E (urea and electrolytes), LFTs (liver function tests), clotting screen, group and save, ABG (arterial blood gas)/VBG (venous blood gas). However, they are often unhelpful as critically ill patients normally have a number of coexisting pathologies, which will also lead to deranged blood results. Blood cultures should be taken if febrile.
- Erect chest X-ray
  - To rule out a chest infection.
  - To look for air under the diaphragm.

- Abdominal X-ray
  - To look for pneumobilia (air in the bile duct, signifying sphincter of Oddi incompetence, biliary-enteric fistula or infection).
  - To look for biliary stents or clips from a previous cholecystectomy.

Specialist investigations following discussion with seniors

- Abdominal ultrasound scan (USS)
  - Ultrasound (US) is the most accurate modality; it reveals a thickened gallbladder wall, absence of gallstones and dilation of the biliary tree. If alternative abdominal pathology is considered more likely, a CT (computerised tomography) abdomen may be more appropriate.

Specific scenario

A diabetic patient on ITU (intensive treatment unit) with chest sepsis develops right upper quadrant pain associated with deranged LFTs.

This patient is at high risk for developing acalculous cholecystitis. Complications such as gallbladder perforation are more common in acalculous cholecystitis and it is therefore important that these patients are promptly managed.

- Assess in an ABCDE manner, taking a history if possible.
- Start IV fluids and IV antibiotics based on hospital policy (e.g. IV co-amoxiclav 1.2 g TDS; if no penicillin allergy, BD if renal impairment).
- Request an urgent USS (to be performed on the unit with a portable machine if the patient is unstable or unable to safely transfer from ITU) and discuss the patient with a senior.

The decision regarding intervention is based on the condition of the patient. Definitive treatment is cholecystectomy, however those who are very unwell may well be too high at risk for a general anaesthetic. In such patients a percutaneous cholecystostomy can be arranged to drain the gallbladder if appropriate. Cholecystectomy can then be considered once the patient's condition improves.

Acute cholangitis

Obstruction of the biliary tree results in stasis of bile (cholestasis). This obstruction is caused by stones (choledocholithiasis) in 80% of cases, however strictures (benign and malignant) and instrumentation can also

lead to obstruction. Stagnant bile becomes infected with gut flora and acute cholangitis develops. This is a serious condition with significant mortality and patients can deteriorate rapidly. Early recognition and management is therefore extremely important.

History and examination

The specific details to elicit are:

- Whether the patient has experienced right upper quadrant pain, fever and jaundice. (Charcot's triad, see Chapter 13).
- Other commonly associated symptoms such as nausea and vomiting.

As part of a full ABCDE examination focus on:

- Assess whether the patient is confused and hypotensive. This can occur in severe cases where the patient has developed sepsis and is known as Reynold's pentad.
- Examination generally reveals right upper quadrant tenderness that is more diffuse than cholecystitis. Murphy's sign is often negative.

Routine investigations

- Ensure alternative diagnoses are ruled out as previously discussed: pregnancy test, urinalysis, erect chest X-ray.
- *Amylase*: If gallstones obstruct at the ampulla of Vater acute pancreatitis can develop (see Chapter 9). It is important to recognise that pancreatitis and cholangitis can coexist and in this situation the two conditions will need treating concurrently.
- WCC (white cell count) and CRP (C-reactive protein) will be raised.
- *LFTs (liver function tests)*: Raised conjugated bilirubin, ALP (alkaline phosphatase) and gamma GT (glutamyl transferase). AST (aspartate aminotransferase)/ALT (alanine aminotransferase) remains normal except in advanced cases where hepatocellular damage has ensued.
- *Blood cultures*: Positive in 50% of cases. Usually caused by Gram-negative bacilli (*Escherichia coli*, *Klebsiella* and *Enterobacter*) or Gram-positive cocci (*Enterococcus*).

Specialist investigations following discussion with seniors

- Abdominal USS
  - Again abdominal US scanning is the first line of investigation. Features of acute cholangitis on US include duct dilatation, choledocholithiasis and bile duct wall thickening.

- Magnetic resonance cholangiopancreatography (MRCP)
  - If the diagnosis is still suspected or the LFTs remain deranged despite a non-diagnostic USS, then MRCP should be considered.

Specific scenario

A patient with right upper quadrant pain, fever and jaundice.

All patients will require broad-spectrum IV antibiotics according to local guidelines (e.g. co-amoxiclav 1.2 g TDS) and fluids. Patients with septic shock should be managed in a high dependency area from the outset and will therefore require prompt discussion with seniors and an intensivist.

- Start IV fluids and broad-spectrum antibiotics.
- Insert a catheter and monitor fluid balance.
- Make nil-by-mouth.
- Urgent senior involvement.

Although these measures will buy some time, definitive treatment requires biliary decompression. Endoscopic retrograde cholangiopancreatography (ERCP) is the approach of choice in the majority of cases, it allows for stone removal ± sphincterotomy ± stent insertion.

If the patient is deteriorating despite fluids and antibiotics, ERCP is done within 12–24 hours, otherwise it can be done at 24–48 hours. Percutaneous trans-hepatic cholangiography (PTC) + stone extraction is undertaken where contraindications to ERCP exist (oesophageal stricture, previous Roux-en-Y gastric bypass) or where ERCP has failed.

Iatrogenic bile duct injury

The incidence of bile duct injury following laparoscopic cholecystectomy ranges from 0.3% to 0.7%. The figure for open cholecystectomy is between 0.1% and 0.2%. Misidentification of anatomy rather than poor surgical technique is the cause in the vast majority of cases.

Presentation

- In some cases an intra-operative cholangiogram will identify the leak in theatre, this can be repaired or managed at the time.
- Otherwise the presentation is generally non-specific. Any patient failing to recover as expected after cholecystectomy (e.g. ongoing abdominal pain, vomiting, fever, anorexia) should be suspected of having a biliary leak.

- Left unrecognised patients can develop biliary peritonitis and subsequently sepsis.
- Some patients may have post-operative abdominal drains; bile in the drain indicates the presence of a bile leak.

Further investigation and management

- US is usually the initial investigation as it is readily available and non-invasive. It can provide information about the presence of an intra-abdominal collection. It may also detect alternative pathologies such as retained stones.
- Further investigation to elucidate the nature of a collection and extent of bile duct injury is based on local resources, clinician preference and patient condition and will require discussion with seniors and a radiologist.
- Management depends on the type and extent of injury; partial lacerations resolve with ERCP and stenting, whilst total transections will require open surgery usually in the form of a Roux-en-Y hepaticojejunostomy by a specialist HPB surgeon (see Chapter 8). Detailed discussion of the various management options is beyond the scope of this text, though the key is to recognise that those patients who are not progressing satisfactorily after a cholecystectomy may have a bile duct injury and to stabilise them whilst awaiting senior input. If there are any signs of sepsis commence broad-spectrum antibiotics according to local guidelines (e.g. co-amoxiclav 1.2 g IV TDS).

Post-ERCP complications

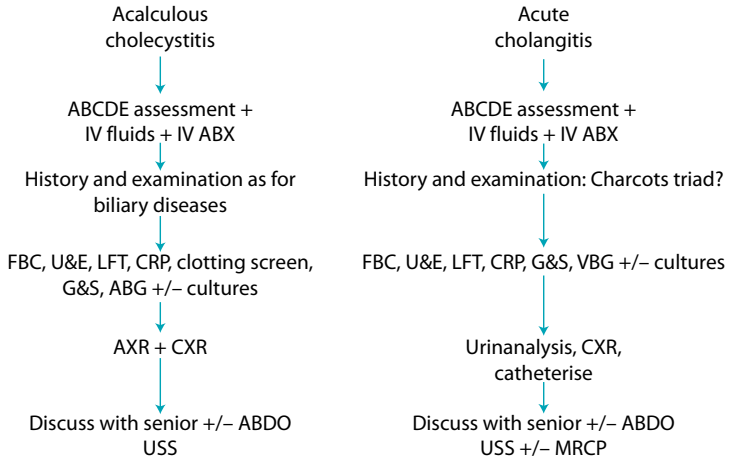
ERCP is now a widely performed procedure for both diagnostic and therapeutic purposes. Patients who have undergone this procedure on the ward are common and it is therefore important to be aware of potential post-ERCP complications:

- *Pancreatitis* (3%): This is the most common complication; serum amylase should be performed to confirm the diagnosis and will be at least three times the upper limit of normal.
- *Duodenal perforation* (0.6%): A serious complication with significant mortality. Presents with worsening abdominal pain, fever, tachycardia and evidence of peritonitis. Have a high index of suspicion with a low threshold for imaging, in the form of a CT AP (CT abdomen and pelvis) with oral water-soluble contrast. Treatment is either conservative with NG (nasogastric) tube, antibiotics and serial

imaging; or surgical, if the perforation is large or the patient very unwell. Ensure senior involvement early.

- *Haemorrhage* (*1%*): This usually occurs after therapeutic ERCP (especially sphincterotomy) and is often mild unless associated with coagulopathy or use of anticoagulants.

Summary algorithm


Acalculous cholecystitis
ABCDE assessment + IV fluids + IV ABX
History and examination as for biliary diseases
FBC, U&E, LFT, CRP, clotting screen, G&S, ABG +/– cultures
AXR + CXR
Discuss with senior +/– ABDO USS
Acute cholangitis
ABCDE assessment + IV fluids + IV ABX
History and examination: Charcots triad?
FBC, U&E, LFT, CRP, G&S, VBG +/– cultures
Urinanalysis, CXR, catheterise
Discuss with senior +/– ABDO USS +/– MRCP

Key questions to ask over the phone when being referred a HPB emergency which will make your time on-call easier:

1. Have bloods been sent for: FBC, U&E, LFT, CRP, amylase and blood cultures if febrile?
2. Has a pregnancy test been performed if the patient is a woman of childbearing age?
3. Has urinalysis been performed?
4. Has an erect CXR been ordered and are any features suggestive of perforation?
5. Have adequate analgesia and IV fluids or antibiotics been given?

Chapter 16
Endocrine surgery

Ross M. Warner and Richard Boulton

This chapter focuses on the surgical management of disorders of the endocrine glands. When on-call for surgery you are most likely to encounter endocrine patients during their post-operative recovery. The knowledge of the common complications and pitfalls will make your time on-call much less stressful.

Thyroid

The thyroid gland consists of two lobes connected by a narrow isthmus overlying the second and third tracheal rings in the neck. It secretes the thyroid hormones T3 (triiodothyronine) and T4 (thyroxine) in response to thyroid-stimulating hormone (TSH) released from the anterior pituitary (regulated by hypothalamic thyrotropin-releasing hormone). Calcitonin (involved in calcium homeostasis) is also produced by the thyroid.

Reasons for being asked to see patients with thyroid disease include:

- Compressive symptoms caused by a goitre.
- Post-operative bleeding/haematoma.
- Recurrent laryngeal nerve (RLN) injury/airway compromise.
- Thyrotoxic storm.
- Hypocalcaemia (see the section 'Parathyroid').
- Painful goitre.

History and examination

The most serious complications surrounding thyroid surgery involve airway compromise. Prior to surgery this could be a result of extrinsic pressure on the trachea from a large goitre. Post-operatively, a similar effect could be seen with bleeding or haematoma. A bilateral RLN injury resulting in the paralysis of the vocal cords would also cause

acute airway obstruction, however, this is likely to present at the time of extubation when the anaesthetist will still be present.

> Note:
>
> If a patient demonstrates any signs of airway compromise, emergency help should be sought from the anaesthetist first, followed by your seniors, ENT surgeons and critical care. Do not hesitate to put out a respiratory arrest call if airway compromise appears imminent.

In other presentations of thyroid disease, details to identify from the history and examination are:

Pre-op:

- Assess the thyroid status of the patient. Look for signs of a thyrotoxicosis (hyperthyroidism): sweating, palpitations, weight loss, irritability, diarrhoea, heat intolerance, fine tremor, AF (atrial fibrillation), goitre, muscle weakness, palmar erythema, eye signs (exophthalmos, lid-lag and retraction in Grave's disease – this accounts for 60%–80% of cases of thyrotoxicosis, and is caused by TSH receptor-stimulating antibodies).
- Signs of extrinsic pressure from a large goitre: dysphagia, dyspnoea (worse while lying flat), swelling of the upper body (head, neck, chest or arms) or headaches/visual disturbance/dizziness suggestive of superior vena cava obstruction. Demonstration of Pemberton's sign: the patient elevates both arms above their head and is positive where there is facial congestion or respiratory distress.
- If there is a painful goitre – how long is the history and are there any accompanying symptoms? The most common cause is De Quervain's thyroiditis (also known as subacute thyroiditis – a self-limiting viral infection that may require steroids).
- Have they had thyroid surgery before? Revision surgery increases the risk of complications compared with primary surgery.

Post-op:

- Any changes in the voice (hoarseness) suggestive of a unilateral RLN injury?
- Any signs of hypocalcaemia including paraesthesia, drowsiness, seizures or tetany? (This can be transient or permanent and is suggestive of parathyroid injury or excision.) Check for Chvostek's sign (twitching of facial muscles in response to tapping over the facial nerve at the angle of the jaw) and Trousseau's sign (spasm of the muscles of the hand as a blood pressure cuff is inflated to greater than systolic blood pressure and left for 3 minutes).

Is there increasing swelling in the neck suggestive of an enlarging haematoma that could cause airway compression if left untreated? IMMEDIATELY inform your senior and if signs of associated airway compromise open the wound on the ward (beware there may be two layers of sutures – although daunting, emergency evacuation of a compressive haematoma is a genuine life-saving manoeuvre expected of you when on-call – see the section 'Specific Scenario').
Thyrotoxic crisis (thyrotoxic storm):

- This is an acute, life-threatening, hypermetabolic state induced by excessive release of thyroid hormone. It is a medical emergency with a 20%–30% mortality rate.
- It is characterised by an acute illness with fever (T >38.5°C), tachycardia, altered mental state, hypertension, vomiting and diarrhoea. Other features include jaundice, seizures, coma or arrhythmia that can lead to congestive heart failure and death.
- Most often seen in a thyrotoxic patient with intercurrent illness, trauma or emergency surgery. If suspected, emergent treatment should be initiated before the TFT (thyroid function test) results are back. Give oxygen, IV (intravenous) fluids, correct electrolytes, control hyperthermia with external cooling/paracetamol (1 g) and treat the precipitating cause. Get senior support immediately and involve ITU (intensive treatment unit) from the start. Beta-blockers (e.g. propranolol 60 mg orally or 1 mg IV over 10 minutes and titrated to response in a monitored setting – contraindicated in asthma, COPD [chronic obstructive pulmonary disease], peripheral vascular disease or decompensated heart failure), antithyroid drugs (e.g. propylthiouracil 200 mg orally), and corticosteroids (e.g. IV hydrocortisone 100 mg) are used with Lugol's solution (aqueous iodine, 1 ml) after 4 hours with ITU and medical/endocrine support as necessary. Local policies may vary so refer to your local guidelines.

Routine investigations

Routine bloods should be ordered including:

- *FBC (full blood count), U&E (urea and electrolyte), LFT (liver function test) and coagulation*: Remember a haematoma post-thyroidectomy is unlikely to cause a drop in haemoglobin.
- *TFTs*: Patients requiring surgery for hyperthyroidism should be euthyroid at the time of surgery. It is also important to remember that many thyroid cancers, in particular papillary and follicular carcinomas are TSH dependent. Patients are therefore usually

on thyroid replacement medication post-operatively to suppress TSH rather than simply to replace the thyroid hormones. Thyroid function tests should be interpreted with extreme caution in these instances and senior advice should be sought before making any changes.

- *ABG* (*arterial blood gas*): May be appropriate to assess oxygenation and respiratory compromise in a patient with compressive symptoms.
- *Chest X-ray*
  - Assesses for retrosternal extension, tracheal deviation and other causes of respiratory distress. If there are any concerns and the patient is stable then you may be asked to request a CT (computerised tomography) neck/chest.

Parathyroid

There are four parathyroid glands situated behind the thyroid gland, intimately related to the RLN and are often variable in position (particularly the inferior glands, see Figure 16.1). The superior parathyroids are located behind the RLN (posteriorly) and the inferior glands are anterior to it. Their identification intra-operatively can be difficult and several methods, which can be used in conjunction, have been developed to identify a solitary adenoma prior to surgery (see subsection 'Specialist investigations following discussion with seniors').

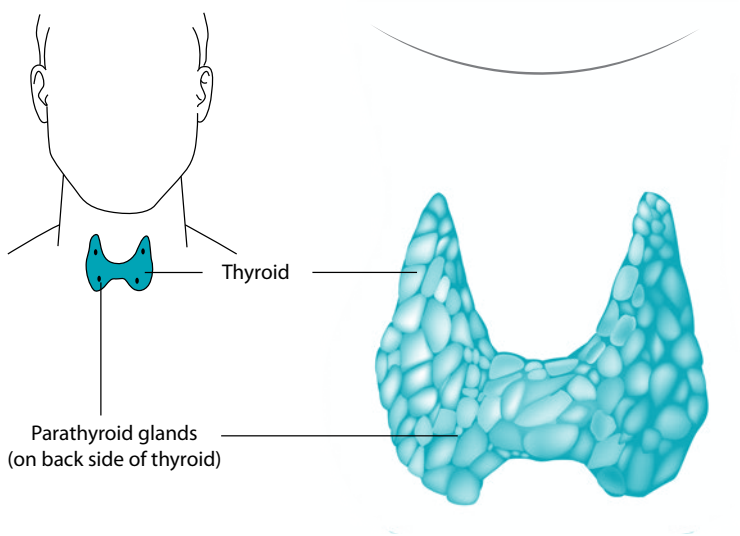


Figure 16.1 Anatomy of thyroid gland.

Complications of parathyroid surgery include RLN injury, airway compromise and bleeding or haematoma, similar to that with thyroid surgery. Transient hypocalcaemia is common post-operatively due to a relative drop in parathyroid hormone (PTH), so remember to check Ca^{2+} levels on day 1 post-op. Normal hormone levels usually recover within a week and function can be regained with just one parathyroid gland, but this usually takes time for the gland to undergo hypertrophy. Hungry bone syndrome is used to describe a severe and prolonged post-operative hypocalcaemia despite normal PTH levels, usually as a result of underlying bone disease (osteitis fibrosa).

The parathyroid glands control calcium and phosphate blood levels through the release of PTH. This acts on the bones (osteoblasts) to increase calcium and phosphate absorption and on the kidneys to increase calcium reabsorption, but block phosphate reabsorption (the kidneys therefore retain calcium and excrete phosphate). This leads to a net rise in serum calcium and fall in serum phosphate. It also converts vitamin D to its active metabolite (1,25-dihydroxyvitamin D3), which works synergistically to increase serum calcium levels.

The most common surgical presentation of parathyroid disease and indication for parathyroid surgery is hypercalcaemia caused by primary hyperparathyroidism (all three types of hyperparathyroidism are summarised in Table 16.1).

Table 16.1 Hyperparathyroidism

Type	PTH	Calcium	Causes
Primary	Normal (inappropriately) or high	High	Tumour of the parathyroid gland
Secondary	High	Low or normal	A low level of Ca^{2+} induces the parathyroid gland increase PTH production as part of negative feedback. Secondary hyperparathyroidism can be seen in chronic kidney disease. It can also be caused by vitamin D deficiency, insufficient Ca^{2+}
Tertiary	High	High	Persistently elevated PTH following years of secondary hyperparathyroidism. There is hyperplasia of the glands and loss of response to serum Ca^{2+}levels

History and examination

Pre-op (hypercalcaemia identification and management):

- Is the patient symptomatic from their hypercalcaemia and therefore requiring urgent medical treatment?
- *Signs and symptoms include*: Polydipsia, polyuria, abdominal symptoms (pain, constipation, vomiting, weight loss, pancreatitis, peptic ulcers), renal tract stones, bone symptoms (pain, pathological fractures, osteoporosis), psychiatric symptoms (low mood, anxiety, confusion), hypertension and rarely cardiac arrhythmias (shortened QT interval).
- *Differential diagnosis of hypercalcaemia*: Multiple myeloma, malignancy (lung cancer releasing parathyroid-related peptide to mimic PTH or bone metastases from breast cancer), Sarcoidosis, excess vitamin D intake, drugs (e.g. thiazide diuretics, lithium), Paget's disease, familial hypocalciuric hypercalcaemia, prolonged immobility, hyperthyroidism or dehydration.
- *Treatment*: IV fluid therapy and correction of any associated hypokalaemia and hypomagnesaemia. Medical management with bisphosphonates or calcitonin may be considered after discussing with your local endocrinologist. Correct the underlying cause, which may involve parathyroidectomy in the case of a parathyroid adenoma.

During your on-call you are most likely to be called to review a post-operative patient with complications on the ward.

Post-op:

- Are there any symptoms of hypocalcaemia? (Numbness around mouth and fingers, carpopedal spasm, cramps, seizures, psychosis, tetany). Check for Chvostek's (twitching of the facial muscles following tapping over the facial nerve) and Trousseau's sign (muscles spasms of the hand and forearm following brachial artery occlusion with a blood pressure cuff).
- If they are hypocalcaemic do they need urgent IV replacement (neurological irritability or serum calcium <1.9 mmol/L)? Commence an infusion of 10% calcium gluconate 10 mL diluted in 100 mL 5% dextrose over 10 minutes followed by 10% calcium gluconate 40 mL in 1 L N. Saline or 5% dextrose over 24 hours as per local policy. Get early advice from the medical registrar on-call and endocrinology team. Put your patient on a cardiac monitor during replacement due to the risk of dysrhythmia if the correction is too rapid.
- Mild hypocalcaemia (>1.9 mmol/L without symptoms) can usually be managed with oral supplementation. Oral calcium (calcichew T BD)

and activated vitamin D (alfacalcidol 1 μg once a day or calcitriol 0.5 μg) should be prescribed. Check with your senior and/or endocrine surgeon as to their preferred medical therapy and monitor serum levels.

- Are there any symptoms of RLN injury or wound haematoma?
- *Review the operation note*: Has a unilateral or bilateral exploration been performed? Were there any immediate complications? Has any residual parathyroid fragment been left behind and transplanted elsewhere (e.g. sternocleidomastoid or brachioradialis muscle)?

Routine investigations

Routine bloods should be ordered including:

- *U&E*: Ensure potassium and magnesium levels are within normal range.
- *Corrected calcium*: The corrected calcium should be checked, which accounts for the patient's albumin level. The result is usually combined with a phosphate level for bone disease.
- *PTH*: Useful in patients with no previous diagnosis of parathyroid disease and abnormal calcium levels. Less important in the acute setting as management focuses around correcting electrolyte imbalances.
- *Vitamin D*: Low levels are associated with a dietary or sunlight deficiency or primary hyperparathyroidism. It helps the intestine to absorb calcium and may require oral replacement if deficient.
- *ECG (electrocardiogram)*
  - Cardiac monitoring may be required in severe cases of calcium imbalance.
  - Hypocalcaemia can cause corrected QT interval prolongation (by lengthening the ST segment). This can lead to arrhythmias such as torsades de pointes, ventricular tachycardia and complete heart block.
  - Hypercalcaemia can cause shortening of the QT interval.

Specialist investigations following discussion with seniors

- These are not performed in the acute setting, but an awareness of the tests requested by specialist endocrine surgeons is useful when dealing with these patients. The main reason for further imaging is to localise a solitary secretory parathyroid adenoma in primary

hyperparathyroidism to allow targeted surgery. Dual localisation with an ultrasound of the neck (75% sensitivity) and nuclear medicine scanning with radiolabeled sestamibi (60%–90% sensitivity) is common. The latter can be combined with single-photon emission computed tomography (SPECT), particularly useful in localising an ectopic adenoma or following failed exploration with persistent hyperparathyroidism. CT scanning with dynamic contrast images (4D-CT [four-dimensional computerised tomography]) may also be employed.

Adrenal

The adrenal glands lie above the kidneys and are composed of a medulla and cortex, each secreting specific hormones (see Figure 16.2). The medulla releases catecholamines (adrenaline/epinephrine and noradrenaline/norepinephrine) in response to sympathetic stimulation. The cortex is divided into three parts and secretes corticosteroids in response to a hormonal stimulus:

- *Zona glomerulosa*: Secretes aldosterone (a mineralocorticoid) in response to angiotensin II (renin-angiotensin-aldosterone system).
- *Zona fasciculata*: Secretes cortisol (a glucocorticoid) in response to ACTH (adrenocorticotropic hormone) (ACTH – released from the anterior pituitary in response to hypothalamic corticotrophic-releasing hormone).
- *Zona reticularis*: Secretes androgens (sex hormones).

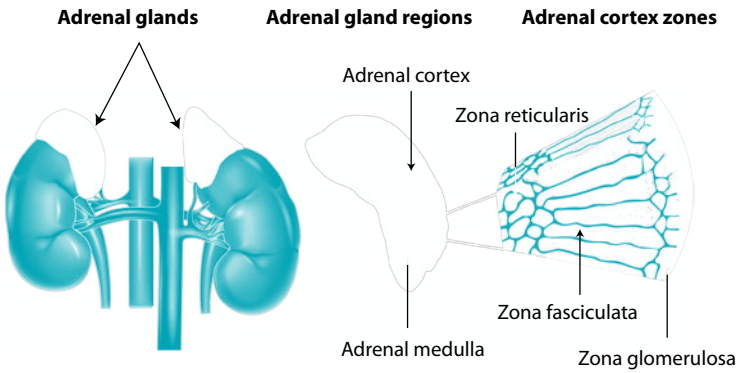


Figure 16.2 Anatomy and internal structure of adrenal glands.

Pathology of the adrenal glands relates to either excess or insufficient hormone production. You are unlikely to encounter these patients on the ward, unless seen post-operatively following laparoscopic or open adrenalectomy, although you should be able to manage an Addisonian crisis with early medical escalation and support (see paragraph relating to Addisonian crisis). The main post-operative complications to watch out for are bleeding and adrenal failure.

A good knowledge of common symptoms and initial investigations are useful in diagnosing and treating these patients.

Addison's disease = primary hypoadrenalism or adrenal cortex insufficiency (low aldosterone/cortisol/androgen).

- *Aetiology*: Majority autoimmune, but consider post adrenalectomy and infection such as TB (tuberculosis).
- *Signs and symptoms*: Hypoglycaemia, hyperkalaemia, nausea, vomiting, fatigue, hyponatraemia and hypotension. Vague symptoms of weight loss, anorexia, myalgia, dizziness, fainting and depression.
- *Investigations*: Common findings include hypoglycaemia, hyponatraemia and hyperkalaemia. Low morning (09:00) cortisol levels and elevated ACTH without a rise in cortisol levels during a Synacthen (synthetic ACTH) test.
- *Management*: Stable patients can be managed with oral glucocorticoid (prednisolone) and mineralocorticoid (fludrocortisone) replacement by an endocrinologist. Patients will need to be educated in the long-term use of steroids, carry a steroid card or wear a medical alert bracelet and have injectable hydrocortisone at home in case of emergency. They will need to double their steroid dose during acute illness and surgery. If any doubt, get advice from your endocrinologist and have their medication history at hand before contacting them.

Addisonian crisis = acute illness due to adrenal failure

- *Aetiology*: Often precipitated by an acute illness (sepsis) or trauma, but also seen following withdrawal of steroid medication.
- *Signs and symptoms*: Severe hypotension and dehydration with low sodium and glucose and elevated potassium levels.
- *Management*: If suspected, assess and treat the patient in an ABCDE (airway, breathing, circulation, disability, exposure) manner with early ITU and senior medical involvement. The mainstay of treatment, however, is IV hydrocortisone (100 mg) given immediately with IV saline (0.9% NaCl) to resuscitate the patient before the confirmation of the diagnosis is made (but send serum cortisol levels). Remember

to check and correct glucose levels, and request an ECG due to electrolyte imbalances. Severe hyponatraemia should not be corrected too quickly due to the risk of central pontine myelinolysis.

Conn's syndrome = primary hyperaldosteronism.

- *Aetiology*: The most common cause is an adrenal adenoma.
- *Signs and symptoms*: Tiredness, weakness, thirst, polyuria, cramps, headaches and hypertension. It should be suspected in patients with hypertension (especially patients <40 years old with resistant hypertension – on three or more agents) and hypokalaemia.
- *Investigations*: Blood tests typically show hypokalaemia and hypernatraemia, with possible metabolic alkalosis. The diagnosis is confirmed with elevated aldosterone and suppressed renin levels (samples taken off medication). Imaging (CT or MRI) can sometimes identify the site of adenoma, although frequently adrenal venous sampling (AVS) is necessary for localisation.
- *Management*: Blood pressure control; spironolactone (aldosterone antagonist), adrenalectomy if lateralisation demonstrated on CT adrenal imaging and/or AVS.

Cushing's syndrome = excess glucocorticoid (cortisol)

- *Aetiology*: Commonly iatrogenic steroid use. Cushing's disease refers to Cushing's syndrome caused by an ACTH-producing pituitary adenoma. Other causes of excess glucocorticoid include ectopic ACTH-secreting tumours (small-cell lung cancer/carcinoid) or adrenal adenoma/hyperplasia/carcinoma.
- *Signs and symptoms*: Truncal obesity, hypertrophied interscapular fat pad (buffalo hump), thin skin with easy bruising and abdominal purple striae, increased skin pigmentation (ACTH-dependent disease), diabetes mellitus/glucose intolerance, proximal myopathy, hirsutism, osteoporosis, hypertension and oedema with a moon-face appearance.
- *Investigations*: Confirm elevated cortisol levels in 24 hour urine (normal <700 nmol) and perform an overnight low-dose dexamethasone suppression test (1 mg orally at 23:00) with the loss of normal suppression (morning plasma cortisol taken at 09:00 is usually <50 mmol/L). ACTH levels are undetectable in adrenal disease. Imaging (CT or MRI) of the adrenal glands ± pituitary can be used to identify the site of the lesion.
- *Management*: Usually surgical resection of the tumour (adrenalectomy or trans-sphenoidal excision of the pituitary gland). This condition is rarely encountered by the on-call surgical team and if suspected should always be discussed with the medical or endocrine registrar.

Phaeochromocytoma = excess catecholamines

- *Aetiology*: Tumour of the chromaffin cells of the adrenal medulla causing excess secretion of catecholamines.
- *Signs and symptoms*: You may be called to see a patient with refractory hypertension and symptoms including palpitations, headache, tachycardia, anxiety, sweating, tremor, weight loss, nausea, diarrhoea, breathlessness and chest or abdominal pain.
- *Investigations*: Blood catecholamine and 24-hour urine metanephrine levels will be elevated. 24-hour urinary 5-HIAA (hydroxyindoleacetic acid) can also be sent to exclude a carcinoid tumour. Phaeochromocytomas are localised via CT or MRI. Scintigraphy with meta-[^{131}I]iodobenzylguanidine (mIBG) can show ectopic tumours.
- *Management*: Definitive treatment requires surgical excision, but good peri-operative blood pressure control is crucial (due to catecholamine release when handling adrenal tissue). The patient must therefore be alpha- and beta-adrenoreceptor blocked pre-operatively with assistance from an endocrinologist (initially phenoxybenzamine for alpha-blockade is started at 10 mg BD and increased by 10 mg every third day until postural hypotension is achieved. Once adequate alpha-blockade obtained, propranolol can be given at 10 mg QDS for beta-blockade to control tachycardia). Patients are likely to be hypotensive following excision so will need IV fluids and careful haemodynamic monitoring. Bilateral adrenalectomy necessitates intra- and post-operative steroids.

Specific scenarios

A patient develops increasing neck swelling and difficulty in breathing post-thyroidectomy.

This is an emergency situation requiring rapid action, taking an ABCDE approach:

- *Senior help should be sought urgently*: Notify anaesthetists, ENT surgeons and theatre staff as appropriate. If imminent respiratory compromise then put out a peri-arrest call to get the necessary support in timely fashion and ensure patient safety. Start high-flow oxygen, sit the patient upright.
- Ensure patient has adequate IV access (two large bore cannulas).
- If signs of airway compromise (stridor, tachypnoea or hypoxia) then open the wound on the ward by releasing the skin sutures or clips.

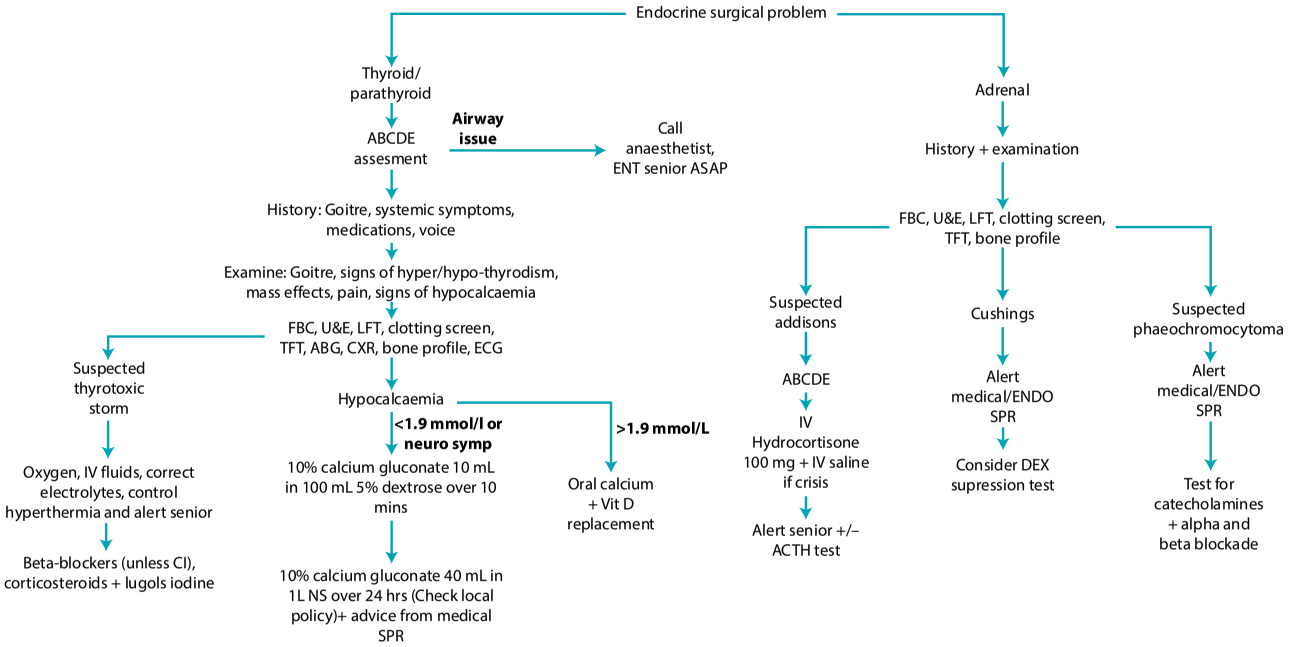
Tip: Remember to release the deeper layer too in order to fully evacuate the constricting haematoma.

- The risks to the patient of opening the wound on the ward are lower than leaving a compromised airway untreated. The patient will then require a return to theatre for a proper wound review, haemostasis and closure.

Summary algorithm

Key questions to ask over the phone when being referred an endocrine surgery case which will make your time on-call easier:

1. Has the patient already had endocrine surgery? What was the operation? When was it?
2. Is there any concern over airway compromise? Has the airway been secured? Has the patient been urgently discussed with ITU/ENT (if appropriate)?
3. Have bloods been taken?


Endocrine surgical problem
Thyroid/ parathyroid
ABCDE assesment
Airway issue
Call anaesthetist, ENT senior ASAP
History: Goitre, systemic symptoms, medications, voice
Examine: Goitre, signs of hyper/hypo-thyrodism, mass effects, pain, signs of hypocalcaemia
FBC, U&E, LFT, clotting screen, TFT, ABG, CXR, bone profile, ECG
Suspected thyrotoxic storm
Oxygen, IV fluids, correct electrolytes, control hyperthermia and alert senior
Beta-blockers (unless CI), corticosteroids + lugols iodine
Hypocalcaemia
<1.9 mmol/l or neuro symp
10% calcium gluconate 10 mL in 100 mL 5% dextrose over 10 mins
10% calcium gluconate 40 mL in 1L NS over 24 hrs (Check local policy)+ advice from medical SPR
>1.9 mmol/L
Oral calcium + Vit D replacement
Adrenal
History + examination
FBC, U&E, LFT, clotting screen, TFT, bone profile
Suspected addisons
ABCDE
IV Hydrocortisone 100 mg + IV saline if crisis
Alert senior +/– ACTH test
Cushings
Alert medical/ENDO SPR
Consider DEX supression test
Suspected phaeochromocytoma
Alert medical/ENDO SPR
Test for catecholamines + alpha and beta blockade

Taylor & Francis
Taylor & Francis Group
http://taylorandfrancis.com

Chapter 17
Vascular emergencies

Stevan Jordan

Acute limb ischaemia

Acute limb ischaemia is a vascular emergency that occurs when there is a sudden occlusion of the arterial supply to a limb. It is commonly caused by either an acute thrombotic occlusion of a previously stenosed arterial segment, or an acute embolic occlusion, most frequently cardiac in origin (atrial fibrillation, MI). Other causes include trauma and aortic dissection. The incidence of acute limb ischaemia in the UK is approximately 1 in 6000 per year and carries a significant mortality rate of 15%–25%.

Surgical revascularisation of the limb *within 6 hours* is critical in preventing patients with complete occlusion from developing extensive tissue necrosis.

The key points to consider in these patients are:

- To assess the severity of ischaemia and whether the limb is threatened.
- To identify whether the ischaemia is secondary to an embolic or thrombotic occlusion.
- To understand the urgent need for surgical revascularisation and recognise complications associated with reperfusion injury.

History and examination

The specific details to elicit are:

- Identify the cause of the ischaemia. Risk factors for the different aetiologies include:
  - Thrombotic:
    - Ask about any history of peripheral vascular disease or chronic limb ischaemia – e.g. leg claudication including distance walked before symptom onset or pain at rest/sleep.

    - Enquire about vascular risk factors – e.g. smoking, elevated cholesterol, diabetes, cardiac history, known peripheral vascular disease.
    - Is there any history of aneurysmal disease within the leg? Thrombosis can occur in popliteal aneurysms.
    - Does the patient have any history of malignancy?
    - Family history of thrombophilia?
  - Embolic:
    - Past medical history of atrial fibrillation, valve disease or myocardial infarction (MI) (mural thrombus).
    - Does the patient have known aneurysmal disease?

- Ask about any history of trauma or previous vascular intervention, including when and where they were performed, and the results if known.

As part of a full examination focus on:

- The classical six Ps of acute limb ischaemia:
  - Pain:
    - Pain is usually at rest but patients may present with acute onset short distance claudication. It is usually worse in the most distal part of the limb and may be relieved on dependency (i.e. hanging legs over the bed).

> **Tip:** Pain worse on passive movement of the muscles indicates potential compartment syndrome and is a poor prognostic sign.

- Pallor:
  - Compare this with the contralateral limb. Acutely ischaemic limbs appear white, while chronically ischaemic limbs may appear red/pink secondary to compensatory vasodilation.
- Pulseless:
  - Assess distal pulses on palpation and using arterial Doppler (if you have access to this).
- Perishingly cold:
  - Compare this with the contralateral limb.
- Paraesthesia:
  - Present in over 50% of cases. Compare the cutaneous sensation of the foot to another area of the body, e.g. upper limb or chest wall.
- Paralysis:
  - A late sign of acute limb ischaemia associated with poor prognosis and irreversible damage to the limb.
- Ensure a full cardiovascular examination is performed.

- Does the patient have an irregularly irregular pulse to suggest atrial fibrillation? An ECG (electrocardiogram) can be performed if in doubt, noting the variable R-R interval and absence of P-waves.
- Can you auscultate a cardiac murmur indicating possible valve disease?
- Is there any evidence of aneurysmal disease within the abdomen or popliteal fossa?
- Are there any scars to indicate previous vascular surgery?
- Review notes/previous clinic letters (where available) to determine previous vascular interventions.

Clinical features can guide the severity of acute limb ischaemia and subsequent management (Table 17.1).

Routine investigations

Routine bloods should be ordered including:

- *FBC (full blood count)*: To help identify patients with haematological disorders that may predispose to thrombosis.
- *Renal function*: Will be required if patient needs urgent CT (computerised tomography) angiography. Patients are also often fluid deplete and may develop a raised potassium with muscle ischaemia and necrosis.

Table 17.1 Clinical features of an acutely ischaemic limb

	Viable (<6 hrs)	Threatened (6–12 hrs)	Irreversible (>12 hrs)
Clinical description	Not immediately threatened	Salvageable if treated promptly	Unsalvageable and amputation unavoidable
Capillary return	Intact	Slow	Absent (marbled/stained appearance)
Motor function	Intact	Partial weakness	Profound paralysis
Sensory loss	None	Partial, incomplete	Profound anaesthesia
Arterial doppler	Audible	Audible/ inaudible	Inaudible

- *Creatine kinase*: May be raised if muscle ischaemia has occurred.
- *Glucose*: To screen patients for diabetes
- *Clotting*: May identify clotting abnormalities and is useful before prescribing heparin to patients.
- *Group and save*: If the patient requires surgery, this will be required as part of the pre-operative workup.
- *ECG:*
  - To identify patients with atrial fibrillation and other cardiac arrhythmias, including acute MI, which may be a source of distal emboli.
- *Hand-held arterial doppler:*
  - To demonstrate residual arterial flow and estimate the level of occlusion in the limb.

Specialist investigations following discussion with seniors

- CT or MR angiography:
  - A fast and accurate imaging modality using intravenous contrast to outline the arterial supply to a limb.
- Digital subtraction angiogram:
  - An invasive procedure requiring arterial puncture and administration of contrast that enables subsequent therapeutic endovascular intervention (angioplasty, thrombolysis).
- Arterial duplex:
  - Non-invasive but operator-dependent imaging modality, with some vessels often difficult to image.

Specific scenarios

Where a patient presents with acute onset very short distance (<50 m) claudication and signs of a viable limb:

- Give analgesia and oxygen as required before getting early senior vascular surgeon involvement.
- Patients usually require admission and heparinisation (see paragraph relating to unfractionated heparin), if not contraindicated, through an intravenous infusion.
- Organise formal arterial imaging within normal working hours, depending on local resources, to plan definitive vascular treatment.

Further management will depend on the results of imaging. Patients may require angioplasty, thromboembolectomy or arterial bypass surgery to manage symptoms. Long-term anticoagulation should be considered.

Where a patient presents with pain in their foot at rest, altered sensation and clinical signs of a threatened limb:

- Contact your senior or vascular surgeon immediately after initial assessment.
- Give analgesia, oxygen and immediate unfractionated intravenous heparin, even if likely to undergo surgery or angiography. This will prevent any propagation of thrombosis.

  Unfractionated heparin: *by IV injection*, loading dose of 5000 units *or* 75 units/kg, followed *by continuous IV infusion* of 18 units/kg/hour *or by subcutaneous injection* of 15,000 units every 12 hours (laboratory monitoring essential using activated partial thromboplastin time (aPTT) – preferably on a daily basis, and dose adjusted accordingly. Follow hospital policy on dosing/monitoring.
- Start fluid resuscitation and keep nil-by-mouth.
- Obtain imaging prior to theatre to identify the site of occlusion, but do not delay intervention.

This cohort of patients will require urgent revascularisation.

Embolic occlusions may be amenable to surgical embolectomy or intra-arterial thrombolysis. In patients with a clear history for embolus and normal contralateral limb, surgical embolectomy can be performed under local anaesthetic. Should embolectomy fail, an on-table angiogram is required and bypass graft or intra-arterial thrombolysis considered.

In patients with thrombotic occlusions treatment involves intra-arterial thrombolysis, angioplasty, thrombectomy or bypass surgery. Patients with arterial graft thrombosis, however, should always receive thrombolysis as the initial treatment.

Intra-arterial thrombolysis involves the administration of intra-arterial streptokinase or recombinant tissue plasminogen activator (rtPA) to break down fibrin clots. After thrombolysis angiography should be performed to identify any underlying stenosis. Complications of thrombolysis are haemorrhage, distal embolisation and haemorrhagic stroke.

Contraindications to thrombolysis

Active bleeding, recent surgery (<2 weeks), stroke (2 months) or trauma (10 days), pregnancy, previous GI (gastrointestinal) bleed and irreversible ischaemic changes.

After successful revascularisation patients need to be monitored for reperfusion injury, where prolonged ischaemia may cause:

- Limb swelling following increased capillary permeability and potential to develop compartment syndrome. Prophylactic fasciotomies may be performed by the surgeon at the time of revascularisation.
- Cell destruction with associated release of potassium, creatine kinase, myoglobin, lactate and oxygen free radicals. This may lead to acidosis, hyperkalaemia, and myoglobinaemia and acute tubular necrosis.
- Management includes close monitoring of renal function and electrolytes with aggressive intravenous fluid replacement, correction of electrolyte abnormalities, and cardiac monitoring for potential arrhythmias.

All patients should be considered for long-term anticoagulation.

Where a patient presents with a numb, pulseless limb with clinical signs of irreversible ischaemia:

- Contact your senior or vascular surgeon immediately after initial assessment.
- Give analgesia, oxygen and commence intravenous fluid therapy.
- Keep nil-by-mouth.

Patients with irreversible ischaemia require either amputation of the affected limb or palliation, with appropriate pain relief and end-of-life care to keep the patient comfortable. Revascularisation is likely to kill the patient, secondary to massive reperfusion injury resulting in renal failure, cardiac toxicity and multi-organ failure.

In the acute setting, analgesia should follow the WHO ladder until pain is adequately relieved. Non-opioids (e.g. paracetamol: 1 g PO [per os (by mouth)]/IV QDS in patients >50 kg) should be commenced, followed by strong opioids if pain is severe (e.g. morphine: 5–10 mg PO 2 hourly or 2.5–5.0 mg IV 2 hourly, if in an appropriate setting).

Palliative analgesia using subcutaneous diamorphine avoids the need for cannulation. Initially prescribe diamorphine 2.5–5.0 mg SC PRN, and after 24 hours if three or more doses are required, consider a continuous infusion via syringe driver. Other drugs can be mixed with diamorphine in a syringe driver to help with agitation, nausea and vomiting.

Key questions to ask over the phone when being referred an acutely ischaemic limb which will make your time on-call easier:

1. Is the patient known to have peripheral vascular disease? Atrial fibrillation? Aneurysmal disease?
2. What were the findings on examination of the affected limb?
3. Has the patient been heparinised? What management has been initiated so far?

Aneurysms

An aneurysm is an abnormal and irreversible dilatation of a blood vessel by at least half its normal diameter. Abdominal aortic aneurysms (AAA) are the most common and affect 5%–9% of the population over the age of 65 years, predominantly men. Patients are usually asymptomatic unless complications arise. Risk factors include atherosclerosis, smoking, hypertension, increasing age, connective tissue disorders, known peripheral aneurysm or a positive family history.

Patients with an AAA are usually offered elective repair to prevent the risk of rupture if they are >5.5 cm in diameter, symptomatic or expanding at a rate of >1 cm/year. Either endovascular or open surgical repair is performed depending on the anatomy, patient comorbidity and preference. Overall mortality in the UK is approximately 3% for open and 1% for endovascular elective AAA repair.

Patients with an AAA <5.5 cm are managed non-operatively with medical optimisation of their risk factors (stopping smoking, BP [blood pressure] and cholesterol control and exercise) and regular ultrasound monitoring, depending on the size of the aneurysm (3.0–4.4 cm – annual ultrasound, 4.5–5.4 cm – 3 monthly ultrasound).

Ruptured abdominal aortic aneurysm

AAA rupture is a vascular emergency and accounts for approximately 12,000 deaths per year in the UK. The mortality is 80% and only half the patients who make it to theatre will survive the surgery.

The key points to consider in these patients are:

- To inform seniors/vascular surgeons immediately of the suspected diagnosis.
- To rapidly resuscitate and prepare the patient for theatre.

History and examination

A ruptured aneurysm should be considered in any male or female over 55 who presents with circulatory collapse.

Ruptured AAA commonly presents with a classical triad of symptoms including:

1. Acute pain in the flank or back (70%)
2. Hypotension (40%)
3. A pulsatile abdominal mass (90%)

Other symptoms may include abdominal pain, syncope and vomiting. As part of your examination focus on:

- Can you palpate a pulsatile abdominal mass?
- Does the patient have an acute abdomen? Bleeding may cause peritoneal irritation and pain.
- Is the patient stable or unstable?

> **Tip:** Presentation can be atypical, e.g. intestinal obstruction from haematoma or an apparent irreducible inguinal hernia, although usually associated with haemodynamic instability.

Routine investigations

Routine bloods should be ordered including:

- *FBC*: Do not be misled by a normal Hb if there has not been time for haemodilution. Anaemia is present in less than half of patients.
- Group and save with rapid cross-match of 10 units of blood, whilst arranging patient for theatre.
- Baseline renal function and electrolytes.
- Coagulation screen to identify any abnormalities and fibrinogen level if dissemination intravascular coagulation (DIC) suspected in massive blood loss or transfusion.
- Portable USS (ultrasound scan)/FAST (focused assessment with sonography for trauma) scan:
  - A quick examination that may identify bleeding and confirm diagnosis.

Specialist investigations following discussion with seniors

- CT angiography:
  - Can confirm the diagnosis in stable patients and provide useful pre-operative information regarding size and involvement of other vessels. It will allow the vascular consultant to determine if emergency endovascular repair is possible.

Specific scenarios

A 67-year-old man presents with abdominal pain associated with hypovolaemia and tachycardia. FAST scan shows a bleeding aneurysm.

This is a surgical emergency – vascular team should be contacted immediately

The unstable patient requires urgent resuscitation and preparation for theatre:

- ABCDE (airway, breathing, circulation, disability, exposure) approach, ask for help early and call '2222' for assistance in the peri-arrest situation.
- Administer high flow oxygen (15 L via non-rebreathing mask).
- Insert ×2 large-bore (12 or 14 G) intravenous access (consider intraosseous access if cannulation difficult).
  - Group and cross-match. The patient will require large supplies of blood and blood products, including platelets and fresh-frozen plasma (major haemorrhage protocols should be initiated by calling '2222').
- Contact theatre staff and anaesthetist immediately to prepare for surgery.

Surgery usually involves open AAA repair with a prosthetic graft, following proximal aortic control. Endovascular techniques, previously reserved for elective AAA repair, are now being used in patients with ruptured aneurysms, with encouraging results.

Patients in whom surgery is likely to be futile may be palliated with appropriate analgesia and sedation as described above.

Thoracic aortic aneurysms

Thoracic aortic aneurysms (TAAs) are predominantly asymptomatic and are commonly only diagnosed incidentally, or if complicated by

dissection or rupture. TAAs become increasingly prone to rupture or dissection once they reach a critical diameter (approximately 6 cm in the ascending aorta and 7 cm in the descending aorta).

Key questions to ask over the phone when being referred a ruptured AAA:

1. Is the patient stable/unstable?
2. Have the vascular surgeons, anaesthetist and theatre been informed?

Aortic dissection

Aortic dissection occurs when an intimal tear of the aorta permits intramural bleeding between the layers of the wall of the aorta, forcing those layers apart. It is the most common aortic emergency with an incidence of 3–4 per 100,000 per year, and typically affects people aged between 50 and 70 years.

The most common risk factor for aortic dissection is hypertension. Others include smoking, raised cholesterol, existing aortic or aortic valve disease, previous cardiac surgery and a positive family history. Familial connective tissue disorders, such as Marfan syndrome and Ehlers–Danlos syndrome also predispose to aortic dissection.

The key points to consider in these patients are:

- To classify the type of aortic dissection and transfer patient to HDU (high dependency unit)/ITU (intensive treatment unit) setting for the ongoing care if appropriate.
- To aggressively treat hypertension, aiming for a systolic blood pressure between 100 and 120 mmHg.
- To involve cardiothoracic surgeons early for consideration of urgent surgical intervention or transfer.

History and examination

The majority of patients with aortic dissection classically describe a severe, sudden onset, tearing pain in their chest or back.

Other symptoms that may occur as a result of the dissecting process are diverse and include:

- *Angina, MI or cardiac arrest*: Involvement of the coronary arteries.
- *Cerebrovascular accident (CVA)/stroke with neurological deficit*: Involvement of the carotid arteries.

- *Abdominal pain*: Involvement of mesenteric arteries.
- *Paraplegia*: Involvement of the spinal arteries.
- *Limb ischaemia*: Involvement of the subclavian artery (arms) and distal aorta (legs).

As part of your examination focus on:

- Does the patient have any cardiac or aortic murmurs? Aortic regurgitation with an audible diastolic murmur is present in approximately 30% of proximal dissections.
- Is there a difference in blood pressure in contralateral limbs?
- Are there differential or absent pulses in the extremities?

Routine investigations

- **Immediate ECG**
- To identify patients with acute MI.
- *Note*: Aortic dissection and acute MI can coexist and anyone with aortic disease and ECG evidence of ischaemia must have diagnostic imaging (see below) before any thrombolytic therapy is commenced.

Routine bloods should be ordered including:

- *FBC*: To establish baseline Hb.
- *Renal function*: Will be required if patient needs urgent CT aortogram.
- *Group and save*: If the patient requires surgery, this will be required as part of the pre-operative workup.
- *CXR (chest X-ray)*
  - A quick examination that may show a widened mediastinum consistent with aortic dissection, but alone is inadequate to exclude the diagnosis.

Specialist investigations following discussion with seniors

- CT aortography
  - A relatively rapid and non-invasive investigation that will confirm the diagnosis in stable patients and with contrast image enhancement visualise the extent of the dissection. It is not appropriate for haemodynamically unstable patients.

- Transoesophageal echocardiography (TOE)
  - An increasingly popular imaging modality useful perioperatively in the haemodynamically unstable patient. TOE is able to image the entire thoracic aorta except for the most distal aspect of the ascending aorta and part of the arch obscured by the trachea or right main bronchus.

Aortic dissection classification

Aortic dissection is commonly subdivided using the Stanford or DeBakey classification systems to help guide management. The Stanford system is split into type A (DeBakey I and II) and type B (DeBakey III), based on the involvement of the ascending aorta (see Figure 17.1). Typically, type A dissections require surgery, while type B dissections are managed conservatively with medical treatment of hypertension.
Stanford classification:

Type A: Dissection involves the ascending aorta (DeBakey II), but may extend into the descending aorta (DeBakey I).

Type B: No involvement of the ascending aorta, dissection originates after the left subclavian artery (DeBakey III).

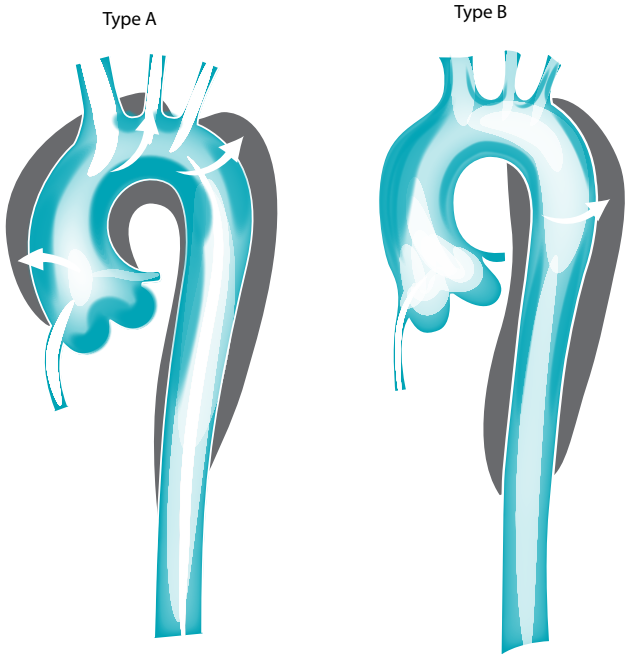


Figure 17.1 Stanford classification of aortic dissection.

Where a patient presents with acute onset 'tearing' chest pain, radiating through to their back:

- Give adequate analgesia (e.g. morphine 5 mg IV, dose titrated to patient response) and oxygen as required and establish intravenous access.
- Perform an immediate ECG to look for evidence of myocardial ischaemia or infarction.
- Organise formal imaging of the aorta, either CT aortography or TOE to confirm the diagnosis.
- Involve the medical team and/or intensive care physicians and arrange transfer to appropriate monitoring environment (potentially HDU/ITU).
- Manage hypertension aggressively with intravenous beta-blockers, aiming for a systolic blood pressure of 100–120 mmHg.
- Involve cardiothoracic surgeons early.

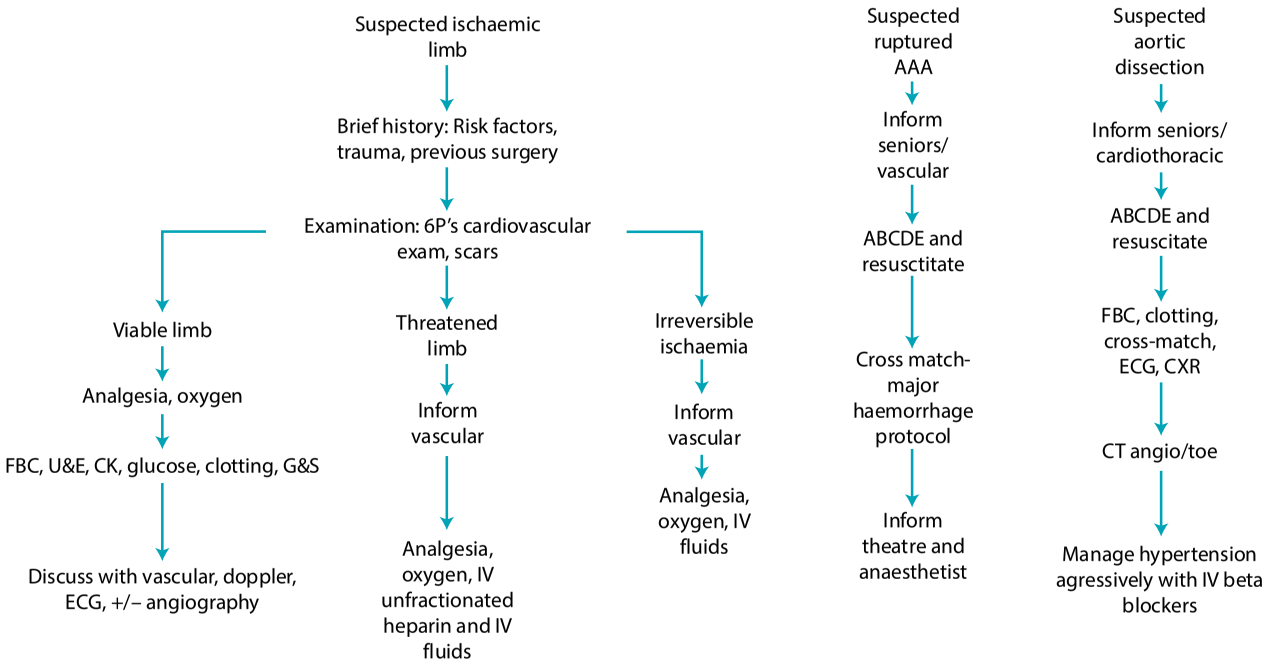
Further management will depend on results of the imaging. Patients will require surgical intervention for Stanford type A aortic dissections, to prevent aortic rupture and pericardial tamponade. This is achieved through the implantation of composite aortic grafts, with or without re-implantation of coronary arteries. Repair can be achieved either through open aortic surgery or thoracic endovascular aortic repair (TEVAR). Type B aortic dissections, in contrast, are usually managed medically with regular clinical and ultrasound follow up.

Patients in whom surgery is likely to be futile may be palliated with appropriate analgesia and sedation as previously described.

Summary algorithm

Key questions to ask over the phone when being referred an aortic dissection:

1. Is the patient stable/unstable?
2. What type of aortic dissection does the patient have?
3. Have the intensive care physicians and cardiothoracic surgeons been informed?


Suspected ischaemic limb
Brief history: Risk factors, trauma, previous surgery
Examination: 6P's cardiovascular exam, scars
Viable limb
Analgesia, oxygen
FBC, U&E, CK, glucose, clotting, G&S
Discuss with vascular, doppler, ECG, +/– angiography
Threatened limb
Inform vascular
Analgesia, oxygen, IV unfractionated heparin and IV fluids
Irreversible ischaemia
Inform vascular
Analgesia, oxygen, IV fluids
Suspected ruptured AAA
Inform seniors/ vascular
ABCDE and resusctitate
Cross match-major haemorrhage protocol
Inform theatre and anaesthetist
Suspected aortic dissection
Inform seniors/ cardiothoracic
ABCDE and resuscitate
FBC, clotting, cross-match, ECG, CXR
CT angio/toe
Manage hypertension agressively with IV beta blockers

Part IV

Post-Operative Complications

Taylor & Francis
Taylor & Francis Group
http://taylorandfrancis.com

Chapter 18
Wound infections and dehiscence

Deniz Hassan

An infected wound caused by a surgical procedure is known as a surgical site infection (SSI). SSIs are one of the biggest contributors to healthcare-associated infections.

SSIs can vary in presentation and include anything from a small weeping wound to a dehisced laparotomy scar ('burst abdomen'), which is a surgical emergency. Wound dehiscence is most commonly caused by infection. The second most common cause is a wound placed under too much tension. A wound under excessive tension due to poor surgical technique is vulnerable to dehiscence in the second week when the patient is beginning to mobilise and the scarring is at its weakest.

The causes of infected and/or dehisced wounds are generally multifactorial. It is therefore important to identify these factors in each patient with a wound infection you are called to see and to not only manage complications but also to minimise the risk of them occurring in the first place.

The key points to consider when managing wound infections are:

- To assess the severity of the wound complications.
- To identify high risk wounds and patients.
- To manage wound complications effectively and safely.

History

- Find out when the patient had the operation. Surgical wound infections typically present between 4 and 10 days post-procedure.
- Is there increasing pain or swelling at the wound site?
- Ask about fever and symptoms of sepsis.
- Has the wound been oozing or bleeding – dressing 'breakthrough'?
- Does it feel like the stitches have burst?

Each surgical wound is different and your history should consider three areas: Patient factors, operative factors and post-operative factors.

Patient factors:

- How old is the patient?
- Do they have any relevant past medical history such as malnutrition (inflammatory bowel disease, malabsorption, malignancy, HIV [human immunodeficiency virus]), metabolic disorders (kidney/liver failure, obesity, diabetes), impaired arterial or venous supply and connective tissue disorders?
- Any previous surgery or radiotherapy?
- Are they taking any medication which might affect wound healing such as steroids, immunosuppressants or chemotherapy?
- Does the patient smoke?

Operative factors (look at operation notes):

- Was the procedure performed electively or as an emergency? Patients undergoing emergency surgery are usually unwell and recovery is more likely to be complicated, despite a normal pre-operative nutritional state.
- Was the wound clean or contaminated? A contaminated wound is at greater risk of post-operative wound infection.
- How long was the surgery? Surgery longer than 7 hours increases the risk of wound infection.
- Were they given antibiotic prophylaxis?
- How was the wound closed? Were there difficulties achieving closure (high tension)? Was it closed in layers? What type of suture (or clip) was used?

Post-operative factors (look at stool charts, fluid balance charts and speak to nursing staff):

- Has the patient had any post-operative complications such as an ileus, haematoma, seroma or intra-abdominal collection?
- Do they have a chest infection, constipation or recent vomiting? The increase in abdominal pressure caused by coughing, vomiting or straining will put extra tension on the surgical repair.
- Have they been mobilising post-operatively?
- What dressings have been used? When were they last changed? Has there been any contamination of the wound (such as spillage of bowel contents or pus)?

Examination

- Look at their general appearance. Are there signs of malnutrition (skin lesions, poor muscle bulk, reduced hair growth)?
- Note the location and size of the wound.
- Is there surrounding cellulitis, macerated (soft, broken down) skin or necrotic skin edges?
- Is there warmth, tenderness or a fluctuant swelling beneath the wound?
- Is there exudate coming from the wound? Is it pus, serosanguinous or fat necrosis? A sudden large release of blood-stained fluid may herald imminent wound dehiscence.
- Has the wound dehisced? If it has, is it superficial (skin and subcutaneous tissue) or deep/full thickness (including dehiscence of fascial planes)? In a full thickness dehiscence the base of the wound would expose intraperitoneal viscera, such as omentum or bowel.
- Is any prosthetic material (such as mesh used in a hernia repair) visible?
- Is there a residual collection of pus or fluid within the wound?

Tip: Beware of the septic, diabetic patient who has had a recent urological, perineal or inguinal hernia operation. They may be developing Fournier's gangrene (see Chapter 23). It is also worth noting that immunocompromised patients may not mount a classical inflammatory response. If you have a high clinical suspicion seek senior advice immediately.

Routine investigations

Routine bloods should be ordered including:

- *FBC (full blood count) and CRP (C-reactive protein)*: To assess the severity of the infection and monitor the trend of inflammatory markers.
- *Renal function*: Will be required if a CT (computerised tomography) scan with contrast is ordered. Renal function can deteriorate in patients with sepsis.
- *Group and save with clotting*: In case the patient requires further surgery, this will be required as part of the pre-operative workup.
- *Glucose*: Careful glucose control (ideally 6–10 mmol/L) is necessary for optimal wound healing. HbA1c level may be useful in diabetic patients.

- *Mg/zinc/selenium*: Important for wound healing and can be depleted post abdominal surgery. These are not ordered routinely but in select cases where long-term nutritional deficiencies are likely.
- *Blood cultures*: If the patient is septic these will help guide antimicrobial therapy.
- *Wound swab*
  - Anyone with a wound infection should have any tissue or fluid sent for microbiology culture and sensitivities (MC&S). Check the results of any samples sent when called to review these patients on the ward.
- *Photograph of the wound*
  - A photograph of the wound, taken with the patient's permission, can be very helpful when discussing the patient with a senior and in monitoring the response to treatment. Do not use your mobile phone – follow your local trust policy on the use of recording equipment and respect patient confidentiality.

Specialist investigations following discussion with seniors

- *Ultrasound or CT scan*
  - These may be ordered if there is suspicion of an underlying subcutaneous collection/seroma/haematoma, but only following senior review as an obvious collection may simply require drainage and washout.
- *MRI*
  - An MRI may be ordered for operative planning if there is suspicion of a fistula.

Specific scenarios

A patient who has recently undergone a laparotomy develops dehiscence of the abdominal wall wound and evisceration of abdominal contents. They initially felt something 'give way' and there was serosanguinous exudate soaking the dressing beforehand.

This is a surgical emergency which is most likely to occur after emergency or complex surgery involving a large laparotomy scar.

- Assess and resuscitate the patient using the ABCDE (airway, breathing, circulation, disability, exposure) approach.
- Cover the exposed bowel in saline soaked gauze. This should be done immediately by the bedside using a sterile technique. Prepare a sterile

field using a sterile drape over the wound and a sterile basin filled with sterile saline solution (0.9% NaCl). Wearing sterile gloves, soak the dressings in the basin and carefully place them over the exposed abdominal contents. A sterile waterproof dressing (such as Opsite or Tegaderm) can then be placed over this to create a seal with the surrounding skin (several dressings may be required to achieve an adequate seal).

- Start IV fluids and prophylactic antibiotics based on hospital policy (e.g. Co-amoxiclav 1.2 g TDS). Consider methicillin-resistant *Staphylococcus aureus* (MRSA) when treating and discuss with microbiology if concerned.
- Keep the patient nil-by-mouth and inform your registrar immediately before informing theatres and the on-call anaesthetist. As a courtesy, inform the original surgical team caring for the patient once they are stable.

This patient will require urgent washout ± debridement ± closure in theatre. Re-suturing of the skin is often inappropriate due to poor tissue quality ± infection and vacuum-assisted closure is often used in these situations to control the wound and expedite granulation formation. Ideally the abdominal cavity is closed directly, however this is not always initially achievable (due to tissue swelling and risk of increasing the intra-abdominal pressure that can lead to abdominal compartment syndrome – see section Abdominal compartment syndrome). An open abdomen wound (known as a laparostomy) is closed temporarily using a sterile plastic bag or vacuum device and may require several returns to theatre for further washout and attempted closure. The patient will likely remain ventilated on ITU (intensive treatment unit) during this period.

Discussion with the plastic surgery team may be necessary if a reconstruction (skin graft or flap) is needed to cover a large defect, although this is usually done several weeks later once sepsis and infection have been treated.

Patients with abdominal wound dehiscence often have multiple co-morbidities and may require specialist medical input. Your senior may request tissue viability nurse review for dressing options and wound advice.

Abdominal compartment syndrome

Defined as sustained intra-abdominal pressure >20 mmHg with new organ dysfunction. If untreated this can lead to renal or cardiac failure, gastrointestinal ischaemia and respiratory compromise. The risk factors for abdominal compartment syndrome are similar to that for an

abdominal dehiscence, and raised intra-abdominal pressure is a known cause of this. Management is multi-factorial:

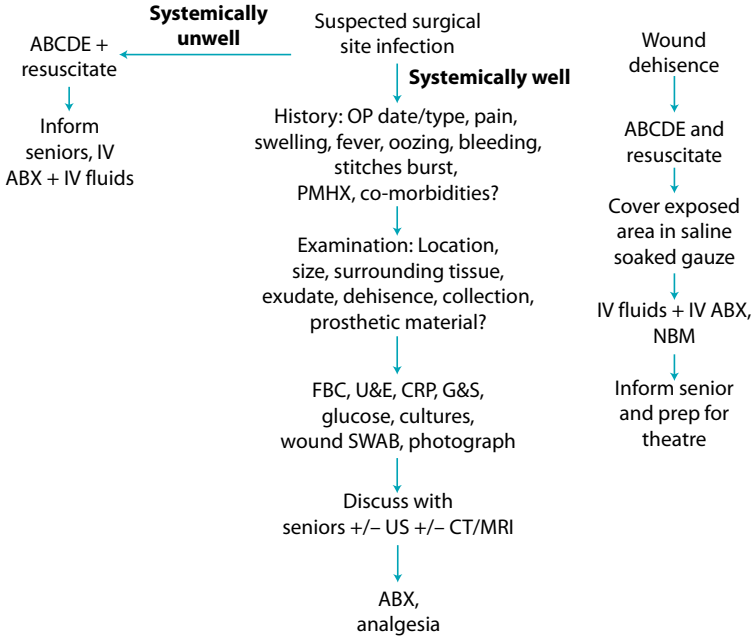
- Improve abdominal wall compliance (sedation, analgesia, paralysis, laparostomy formation).
- Evacuate intra-luminal contents (NGT [nasogastric tube], enema, prokinetics such as Metoclopramide 10 mg TDS).
- Evacuate abdominal fluid contents (percutaneous drainage or washout ± laparostomy).
- Correct positive fluid balance (diuretics, haemofiltration and avoid excessive IV fluids. Maintain normal protein levels through adequate nutrition such as TPN [total parental nutrition]).
- Organ support (on ITU).

Where a patient has developed a minor post-op wound infection or superficial dehiscence:

- Assess the patient using an ABCDE approach to rule out severe infection.
- Take a wound swab.
- If signs of localised or systemic infection as previously described start the patient on antibiotics based on hospital policy (e.g. Co-amoxiclav 1.2 g TDS in abdominal surgery) and send routine blood tests including cultures if septic.
- Inform the original operating surgical team.

The most common cause for dehiscence is infection. Wounds are then often left to heal by secondary intention (the wound is not closed and is instead left to granulate) and the mainstay of treatment is regular cleaning and dressings. The wound can be lightly packed following washout (either on the ward or in theatre) to allow any pus to continue draining. Larger wounds may be amenable to vacuum assisted closure. Remember to optimise the nutritional state of the patient, treat infection and control blood glucose levels.

Summary algorithm


Systemically unwell
ABCDE + resuscitate
Inform seniors, IV ABX + IV fluids
Suspected surgical site infection
Systemically well
History: OP date/type, pain, swelling, fever, oozing, bleeding, stitches burst, PMHX, co-morbidities?
Examination: Location, size, surrounding tissue, exudate, dehisence, collection, prosthetic material?
FBC, U&E, CRP, G&S, glucose, cultures, wound SWAB, photograph
Discuss with seniors +/– US +/– CT/MRI
ABX, analgesia
Wound dehisence
ABCDE and resuscitate
Cover exposed area in saline soaked gauze
IV fluids + IV ABX, NBM
Inform senior and prep for theatre

Key questions to ask over the phone when being referred a wound infection which will make your time on-call easier:

1. What operation was performed and what was the indication?
2. When was the operation?
3. How unwell is the patient? Are they septic? Review their observations.
4. Have other causes of infection been ruled out such as chest sepsis, urosepsis, etc.?
5. What were the blood results? (Request they be performed if not yet done.) Request septic screen (blood cultures, CXR (chest X-ray) and urinalysis) if pyrexial.
6. Have wound swabs been taken?
7. Has the patient been cannulated and IV fluids/antibiotics started?

Taylor & Francis
Taylor & Francis Group
http://taylorandfrancis.com

Chapter 19

Management of an anastomotic leak

Ross M. Warner

The term anastomotic leak generally refers to leakage of bowel contents from a newly formed bowel anastomosis. It is also a recognised complication of urinary anastomoses.

The incidence of a bowel anastomotic leak varies by site due to several factors (explained below), including local blood supply. They are more common with oesophageal and rectal anastomoses compared to the lower risk small bowel anastomoses. Urine leaks can occur with any anastomosis involving the ureter, bladder or with use of the small bowel such as an ideal conduit.

An anastomotic leak generally presents in one of the two ways:

- Severe life-threatening generalised peritonitis.
- Gradually worsening symptoms and observations suggestive of a smaller contained leak.

Patients can present with very non-specific symptoms including failure to progress at the expected recovery rate. For this reason, any patient you are called to see who has recently had an anastomosis should be considered to have a leak until proven otherwise. Other differentials include bowel obstruction, post-operative ileus, bowel ischaemia and intra-operative bowel injury.

The key points to consider in patients with anastomotic leaks are:

- To have a high index of suspicion that a leak has occurred in any recently post-operative patient.
- To resuscitate the patient appropriately and discuss with a senior the need for further imaging or surgery.

History and examination

The specific details to elicit are:

- Why was the operation done and was it elective or an emergency?
- *Where is the anastomosis*: It is useful to check the operation note as this may provide a clue to the difficulties encountered in surgery and site of anastomosis or bowel injury and repair. Remember, an anastomosis downstream from a defunctioning stoma could still leak, although the consequences are usually less severe.
- *Pain*: Severity, location and nature. Do they need to keep as still as possible (suggests peritonitis) or can they not sit still with the pain? Is the pain out of proportion to the clinical signs?
- Is there pain and/or a lump specifically at the incision or port site suggestive of a hernia?
- Any symptoms indicative of obstruction?
- *Fever*: May suggest a localised collection or abscess.
- Is there another source of sepsis? Check for symptoms of a chest or urinary infection.
- *Does the patient have any symptoms suggestive of a fistula*: A leak may present this way. For example, bowel content discharging from the wound or skin in an enterocutaneous fistula, pneumaturia (passage of gas in urine) in a colovesical fistula, constant urinary incontinence from the vagina in a vesicovaginal fistula or bowel contents discharging from the vagina in a colovaginal fistula.
- Any rectal or stomal bleeding?
- Does the patient have any risk factors that make a leak more likely:
  - Operative factors:
    - Poor blood supply to bowel ends.
    - Tension on the anastomosis.
  - Patient factors:
    - Immunosuppression (review their medication and co-morbidities).
    - Malnutrition.
    - Diabetes.
  - Disease-specific factors:
    - Obstruction.
    - Sepsis.

As part of a full examination focus on:

- Signs of dehydration.
- Signs of sepsis.

- *Signs of peritonitis*: Rigidity, guarding, rebound tenderness.
- Is there a palpable mass?
- Is there a drain? Faecal matter in the drain suggests a bowel leak.
- Is there a fistula?

> **Tip:** Do NOT perform a rectal examination in a patient with a new rectal anastomosis or following prostatectomy due to the risk of disrupting the suture/staple line.

Routine investigations

Routine bloods should be ordered including:

- *FBC (full blood count)*: These patients will have had recent surgery. It is crucial to check their haemoglobin as a drop could be a possible cause for deranged bedside observations and the patient feeling unwell. It will also help to guide whether a transfusion is needed before another potential operation. An elevated WCC (white cell count) may indicate sepsis or a collection.
- *CRP (C-reactive protein)*: For assessing signs of infection and response to treatment.
- *Renal function*: Dehydration can cause renal impairment or the patient may have an electrolyte disturbance. The renal function must be known if a contrast CT (computerised tomography) scan is requested.
- *Group and save/cross-match*: A significant proportion of these patients will need to go back to theatre. The previous blood sample may still be valid.
- *VBG (venous blood gas)*: A raised lactate may suggest bowel ischaemia or shock.
- *Coagulation*: Any clotting disturbance must be known before taking a patient back to theatre or arranging percutaneous drainage procedures. Derangement may also suggest significant illness and multi-organ dysfunction.
- *Urinalysis:*
  - Could urosepsis be the cause of their symptoms? Patients undergoing urological procedures are at higher risk. General surgical patients are also often catheterised prior to their operation, increasing their risk of a urinary tract infection (UTI). Interpret urinalysis results in clinical context as catheters are frequently colonised so may or may not represent infection.

- *Drain fluid for creatinine:*
  - Useful if there is suspicion of urine leak.
  - A drain creatinine level similar to normal urine suggests a leak, a drain creatinine level similar to serum suggests otherwise.
- *Erect chest X-ray:*
  - Assess for chest infection or pneumoperitoneum.
- *Abdominal X-ray:*
  - To assess for bowel obstruction (suspect if bowel diameter >3 cm for small bowel, >6 cm large bowel and >9 cm caecum).

Specialist investigations following discussion with seniors

- CT abdomen and pelvis (with contrast if renal function allows):
  - If the patient is stable and does not have generalised peritonitis, then a CT is likely to be highly useful in identifying the cause for the patient's symptoms and subsequent management. It is crucial to inform the radiologist exactly what your diagnostic query is since the scanning protocol used for assessing urinary versus bowel leak, for example, is different.
- Contrast study:
  - Water-soluble contrast studies can be used to assess for possible rectal anastomotic leaks, as can urethrograms or cystograms for suspected urinary leaks.

Specific scenarios

Where a patient is 5 days post-cystectomy and ileal conduit formation and is becoming gradually more unwell with tachycardia and fever.

- History and examination should help guide towards a likely cause.
- If a drain remains in situ send the fluid for culture and biochemistry (creatinine).
- Send routine blood tests, including blood cultures if septic and perform urinalysis as mentioned above.
- A senior should review the patient with a view to diagnostic imaging (likely CT of the abdomen and pelvis if the diagnosis is unclear at this stage).
- Definitive management will vary depending on the findings. This could range from conservative management with antibiotics based on local

guidelines (e.g. IV Co-amoxiclav 1.2 g TDS) to radiologically inserted drains or a return to theatre.

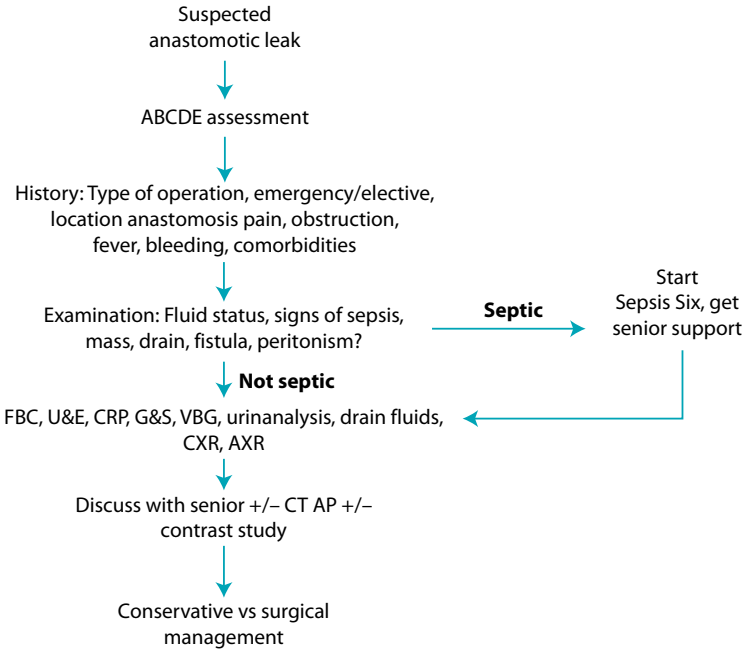
- It may be appropriate to consider alternative nutritional routes at this point and specialist stoma nurse review (for pre-operative marking of stoma site if a return to theatre is planned).
- Regular reassessment for response to treatment should be undertaken and involve the outreach team ± ITU (intensive treatment unit) if the patient is acutely unwell.

Where a post-operative patient following a right hemicolectomy is showing signs of severe sepsis and generalised peritonitis.

If a patient has generalised peritonitis they will be very unwell. An 'ABCDE' (airway, breathing, circulation, disability, exposure) approach should be used to resuscitate and stabilise the patient. Senior support should be asked for as soon as possible. This patient is likely to require an emergency laparotomy.

- Insert two large bore cannulas (12–14 G), take blood cultures and repeat blood tests. Follow your local sepsis pathway, starting IV fluids and broad-spectrum antibiotics (e.g. IV Co-amoxiclav 1.2 g TDS and IV metronidazole 500 mg TDS).
- Keep nil-by-mouth.
- Insert a catheter if not already in situ, send urine for culture and commence close fluid balance monitoring.
- *Prescribe analgesia*: Their requirements will significantly increase even before they became peritonitic and therefore their drug chart should reflect this change. This could involve asking the anaesthetists to setup an opiate-based patient-controlled analgesia (PCA) pump, particularly if the patient does not require immediate surgery.
- Senior support should be sought urgently at this point if not already done so. Ideally, this should include both the on-call team and the original operating surgeon if they are different.
- If the plan is to take the patient back to theatre then the on-call anaesthetist and theatre coordinator will need to be made aware of it.
- The patient is likely to need an intensive care bed booking for immediate post-operative management, inform the relevant individuals and calculate the patient's peri-operative predicted morbidity/mortality. The P-POSSUM (Physiological and Operative Severity Score for the enUmeration of Mortality and Morbidity) score is commonly used and can be found easily on the internet (such as www.riskprediction.org.uk).
- In these circumstances a CT scan of the abdomen and pelvis is only indicated if the patient is stable and there is diagnostic uncertainty. A final diagnosis will otherwise be made at the operation.

Summary algorithm


Suspected anastomotic leak
ABCDE assessment
History: Type of operation, emergency/elective, location anastomosis pain, obstruction, fever, bleeding, comorbidities
Examination: Fluid status, signs of sepsis, mass, drain, fistula, peritonism?
Septic
Start Sepsis Six, get senior support
Not septic
FBC, U&E, CRP, G&S, VBG, urinanalysis, drain fluids, CXR, AXR
Discuss with senior +/– CT AP +/– contrast study
Conservative vs surgical management

Key questions to ask over the phone when being referred an anastomotic leak which will make your time on-call easier:

1. When and what was the operation? Who performed it?
2. Have a recent set of observations been performed? Are any of the observations abnormal? What are they?
3. Have bloods been taken and cannulas inserted?
4. Is the patient catheterised? What is their urine output?
5. When did the patient last eat and drink?

Part V

Trauma

Taylor & Francis
Taylor & Francis Group
http://taylorandfrancis.com

Chapter 20
Trauma principles

Stevan Jordan

Trauma is the leading cause of death in children and young adults below the age of 40. It accounts for approximately 12,500 deaths each year in the UK. Over the last few years, regional trauma networks, with dedicated major trauma centres, have been introduced to improve the quality and organisation of trauma care and help save lives.

The initial assessment and management of trauma victims is time critical and requires a rapid and systematic approach. A dedicated 'Trauma Team' performs these steps simultaneously in practice under the direction of a 'Team Leader'. Good initial care is vital in preventing early trauma mortality.

The key points to consider in trauma are:

- To organise team roles and prepare for arrival of the patient.
- To rapidly assess the patient using a systematic approach.
- To identify and treat life-threatening injuries early.
- To reassess following intervention.
- To provide definitive treatment or organise transfer for definitive care.

Trauma team preparation

In most circumstances, the trauma team is alerted and mobilised early to allow for preparation prior to the patient's arrival. A team leader, usually the most senior figure, should be identified and team roles allocated; these should normally include:

- Team leader
- *Airway assessment*: The attending anaesthetist
- *Primary survey*: Any team member ideally with advanced trauma life support (ATLS) training

- *Cannulation*: Any team member
- *Scribe*: Any team member, to document trauma assessment
- *Others*: To aid with imaging requests/transfer

The resuscitation area should be prepared and team members should don personal protective equipment (apron and non-sterile gloves).

Handover

A succinct handover from the pre-hospital care team is important and provides a substantial amount of information about the patient's current condition and potential injuries. It is important that the whole team listens to this handover, but should not delay emergency life-saving treatment.

Initial assessment

The initial assessment of a trauma patient includes:

- Resuscitation and primary survey
- Secondary survey
- Definitive treatment or transfer for definitive care

Resuscitation and primary survey

The aim of the primary survey is to identify and treat life-threatening injuries early. It focuses assessment and treatment on the system with the greatest threat to life first, before progressing to the next most important system. In practice the primary survey will occur simultaneously with resuscitation. A simple mnemonic, C-ABCDE, can be used as an aide-memoire to recall the order of assessment.

C – Catastrophic haemorrhage

- Any major source of bleeding should have pressure applied to try and stem the flow of blood, until a more definitive treatment can be provided. Tourniquets can be considered in traumatic amputations.

A – Airway maintenance with cervical spine (C-spine) protection

- Are there any signs of airway obstruction? Assess the patient's airway for:
  - Foreign bodies (including blood, saliva, vomit, broken teeth).
  - Facial or laryngeal trauma.

- Signs of inhalation burn injury and impending airway obstruction (facial burns, singeing of eyebrows/nasal hair, blistering of the oropharynx, carbonaceous sputum, hoarseness and stridor).
- Management may involve control of secretions using suction, intubation or performing a surgical airway (e.g. cricothyroidotomy, emergency tracheostomy).
- Maintain a clear airway using simple manoeuvres, such as chin lift or jaw thrust, ensuring cervical spine protection at all times. (Remember head tilt is NOT a safe procedure in this situation). A patient who is able to talk is likely to have a safe airway, but this should be rechecked throughout the primary survey.
- What is the patient's Glasgow Coma Scale (GCS)? If reduced, an oropharyngeal (Guedel) airway can be inserted as an initial measure to aid ventilation. If poorly tolerated, a nasopharyngeal airway can be used, providing there are no contraindications, such as severe head/facial injuries or evidence of basal skull fracture (i.e. Battle's sign, raccoon eyes, cerebrospinal fluid/blood from ears).
- A definitive airway should be established in patients with a GCS <8.
- *Cervical spine protection*: All trauma patients should be assumed to have a cervical spine injury until proven otherwise. C-spine protection is therefore critical throughout the primary survey using in-line immobilisation. Imaging can be conducted once the patient has been stabilised.

B – Breathing and ventilation

- Provide high-flow oxygen (15 L O_2/min) through a non-rebreathe mask.
- Perform an examination of the patient's chest, focussing on:
  - Are there any signs of thoracic trauma (bruising/contusions)?
  - Is there equal chest expansion? Is the trachea central?
  - On auscultation is there equal air entry bilaterally?
  - Is percussion of the chest resonant and equal throughout?
- Life-threatening conditions affecting breathing and ventilation include:
  - Tension pneumothorax
    - *Clinical signs may include*: Tracheal deviation away from the affected side, with decreased breath sounds, reduced chest expansion and hyper-resonance on that same side.
    - Management requires immediate needle decompression (landmark – second intercostal space, above third rib, mid-clavicular line) followed by definitive surgical chest drain insertion (landmark – fifth intercostal space, anterior to the mid-axillary line). Remember the intercostal vessels run along the lower border of the ribs – avoid these by going just above the rib.

- Haemothorax
  - *Clinical signs may include*: Tracheal deviation away from the affected side, with decreased breath sounds, reduced chest expansion and dullness to percussion on the affected side.
  - Management will usually require insertion of a surgical chest drain. If the chest drain produces >1000 mL of blood on insertion or >200 mL/hour for 2–4 hours (massive haemothorax) then surgery and exploratory thoracotomy may be required (your seniors should be involved early if they are not already part of the trauma team).

- Flail chest
  - Classified as 'a fracture of two or more ribs in two or more places'. The flail segment moves in the opposite direction to the chest wall in both inspiration and expiration. This is extremely painful and is associated with underlying pulmonary contusion progressing to respiratory fatigue or failure.
  - Management requires significant analgesia and careful ventilatory support.

C – Circulation with haemorrhage control

- Haemorrhage is the main preventable cause of death after trauma and the commonest cause of circulatory compromise.
- To assess blood loss and perfusion rapidly focus on vital signs, including:
  - Pulse rate
  - Respiratory rate
  - Consciousness level (GCS)
  - Blood pressure

> **Tip:** Hypotension is often a late sign

- Examination should help identify common sources of major haemorrhage. Focus on:
  - Abdomen:
    - Does the patient report any abdominal, flank or back pain?
    - Is there any abdominal or lower chest bruising? Are there any lower rib fractures? (Suspect splenic or liver injury.)
    - Is there abdominal tenderness or rigidity on palpation?
    - Focussed assessment with sonography in trauma (FAST) scan by trained members of the trauma team is a quick and efficient tool in identifying intra-abdominal fluid (likely acute bleeding).

- Pelvis:
  - Palpation and springing of the pelvis is not advised and patients should have pelvic binders applied if there is any suspicion of injury. This can be confirmed by CT (computerised tomography) once the patient is stable enough for transfer to radiology.
  - Suspect a pelvic fracture when there is pain, swelling or bruising around the hip or groin.

- Long bones (humerus, femur):
  - Does the patient report any pain in their arms/legs?
  - Any clues from the history and how the injury was sustained?
  - Is there an obvious deformity of the limb or crepitus on passive movement?
  - If clinically suspected long bone fractures should be splinted to reduce blood loss.

Tip: Open fractures can bleed significantly and the patient can rapidly exsanguinate. They may require urgent surgery.

- Resuscitation of patient with suspected haemorrhage should include:
  - IV access with two large-bore cannulae (12–14 G), ideally in the antecubital fossa. Take blood simultaneously for cross-match and baseline FBC (full blood count), U&E (urea and electrolytes) and clotting.
  - *Note*: If IV access is difficult peripherally, intraosseous access should be considered.
  - IV fluids should be started immediately with crystalloid solution until cross-matched blood becomes available. If haemorrhage is immediately life-threatening group O-negative blood can be utilised and a massive transfusion protocol initiated.

D – Disability: Neurological status

- Rapid neurological assessment should be performed to assess:
  - *Consciousness level*: Using GCS
    - All patients with a significant reduction in GCS (<13) as a result of head injury should undergo a CT head to look for evidence of contusion and exclude haemorrhage.
    - Document the GCS breakdown (eyes, voice and motor response) to aid early identification of deterioration. See Chapter 22 on how to calculate the GCS.
  - *Pupils*: Size, symmetry and reaction
    - Pupil dilation or asymmetry, with impaired or absent light reflexes may indicate an expanding intracranial bleed. An urgent CT

head is necessary and prompt referral to neurosurgeons if the diagnosis is confirmed as they may require emergency surgery to reduce the pressure effect. Document clearly any discussions with the neurosurgeons and advice given.

- Patients with a significant head injury need regular neurological monitoring, as rapid deterioration can occur following an apparently lucid interval (see Chapter 22 for an extradural haematoma).
- Check blood glucose.

E – Exposure/environmental control

- Patients should be fully exposed during the primary survey, with clothes removed or cut off as necessary. Heat loss can be prevented using blankets or warming devices once the examination is complete.
- It is often appropriate to perform a log-roll at this stage to look for any injuries to the back and assess the thoracic and lumbar spine.
- *Adequate analgesia should also be prescribed*: IV paracetamol 1 g QDS and IV morphine: initially 5 mg IV, titrating dose to severity of pain and patient response. Monitor for signs of opioid toxicity including respiratory depression. Naloxone can be used to reverse the effects of opioids (IV 400 μg, repeated after 1 minute if no response).

Other investigations

Diagnostic investigations should aid management in the primary survey but not delay resuscitation efforts. Most investigations can be delayed until the primary survey is complete.

- *X-ray*
  - Most trauma patients require a chest X-ray. Other imaging will be guided by examination findings and potential decision to investigate with CT.
- *CT scan*
  - Increasingly used for assessing internal injuries. Scans may include the following:
    - *Head*: Important in ruling out life-threatening intracranial bleeds.
    - *Cervical spine*: Necessary in patients with suspected cervical spine injury.
    - *Abdomen/pelvis*: Useful in detecting abdominal bleeding using arterial and venous phase scans and evaluating pelvic fractures.
    - *Chest*: Useful following acute thoracic interventions in the primary survey and in the diagnosis of occult thoracic injuries and significant rib fractures.

- *ECG (electrocardiogram)*
  - Useful as a baseline. Essential in patients with blunt thoracic trauma who will require continuous cardiac monitoring if cardiac contusion is suspected.

Secondary survey

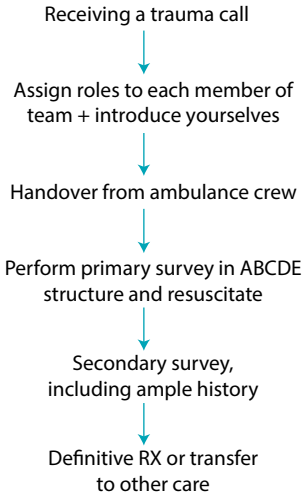
After the initial assessment and resuscitation, a secondary survey can be performed to complete a thorough examination of the patient from head to toe. This should identify any other serious injuries that may require further investigation and imaging.

A complete medical history should also be obtained at this time; a common mnemonic used is 'AMPLE':

- A – Allergies
- M – Medications
- P – Past medical history
- L – Last meal – what time?
- E – Events/environment relating to the injury

Definitive treatment and care

Following the secondary survey a decision regarding where the patient's ongoing treatment should continue should be made. This will be


Receiving a trauma call
Assign roles to each member of team + introduce yourselves
Handover from ambulance crew
Perform primary survey in ABCDE structure and resuscitate
Secondary survey, including ample history
Definitive RX or transfer to other care

governed by the condition of the patient and facilities available at the local hospital. Trauma networks exist within the UK so that the patient's care can be fast-tracked to units most suitable and experienced in dealing with certain injuries to improve patient outcomes.

Chapter 21
Burns

Stevan Jordan

Burns can occur following exposure to thermal, chemical, electrical, or radiation energy. In the UK there are approximately 250,000 burn injuries each year, with the highest incidence seen in children (<5 years) and the elderly (>75 years).

Burn injuries vary considerably in severity and whilst most minor burns can be managed in primary care, all major burns (see airway assesment paragraph as part of primary survery section) require specialist management from a multidisciplinary team to achieve good clinical outcomes. Initial resuscitation following basic trauma principles is vital in the immediate management of all major burns.

The key points to consider in burns admissions are:

- To resuscitate the patient according to trauma principles (ABCDE [airway, breathing, circulation, disability, exposure]).
- To assess severity of the burns and recognise complications early, especially impending airway compromise.
- To identify patients requiring referral to a specialist burns unit.

Immediate assessment

- Assess ABCDE and resuscitate as appropriate.

Assess severity of burns and need for fluid resuscitation (see Parkland formula).

Parkland formula = 3 (previously 4) × Weight (kg) × (% burn) = Volume (mL) given in 24 hours, 50% given in first 8 hours

History and examination

The specific details to elicit are:

- Identify the exact mechanism of injury including duration of contact and timing of burn. In children, are there any signs of NAI (e.g. delays in seeking medical attention, injuries out of proportion to proposed mechanism, inconsistencies in history or evidence of other unexplained injuries)? If you have any concerns over NAI discuss with the paediatricians if they are not already involved in the patient care.
- Ask about factors indicating potential inhalation injury e.g. burns sustained in an enclosed space or associated loss of consciousness.
- Details and timings of any first aid already given.
- Brief past medical history, including any medications or allergies.
- Tetanus immunisation status (give booster if out of date e.g. 0.5 mL IM [intramuscular] Revaxis).

As part of a full examination focus on:

- Are there any signs of inhalation injury? (See subsection 'Primary survey'.)
- What is the total surface area of the burn?
- What is the depth of burn? Are the burns circumferential?

Estimating body surface area of burn:

- *Rule of Nines*: In adults the body can be divided into anatomical regions that represent 9%, or multiples of 9%, of the total body surface area (TBSA). The head and each upper limb represent 9%, the front of the torso, back of the torso and each lower limb represent 18% and genitalia 1% (Figure 21.1).
- The palmar surface of the patient's hand is approximately 1% TBSA.
- *In children TBSA differs considerably*: The use of a Lund and Browder chart is the most accurate method to determine TBSA, taking into account changes with age and growth.

Classifying the depth of burn:

- *Superficial simple erythema (epidermal)*: Red, glistening, painful, absence of blistering and brisk capillary refill. Appearance resembles sunburn. Usually heals within a week without scarring. This does NOT count towards TBSA.
- *Superficial partial thickness (dermal)*: Red, mottled, and wet appearance with associated blistering and swelling. Painfully hypersensitive with a brisk capillary refill. Heals within 2–3 weeks with minimal scarring and full functional recovery.

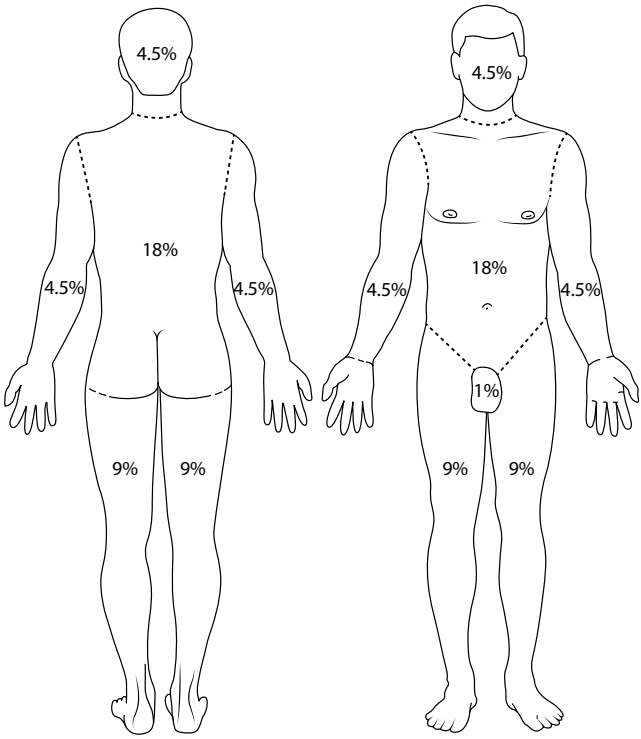


Figure 21.1 Rule of Nines: Adults.

- *Deep partial thickness (dermal)*: Blotchy red, blistering, dry, non-blanching, no capillary refill and reduced or absent sensation. This may require surgery (excision and skin graft) and is associated with delayed healing (3–8 weeks) and considerable scarring.
- *Full thickness*: White or black, dry, no blisters, absent capillary refill and sensation. Without surgery it will lead to scarring and contracture. If circumferential, it can lead to distal ischaemia requiring escharotomy, a surgical procedure in which eschar, the tough leathery tissue that remains after a full thickness burn, is incised to release tension on the underlying tissues.

Routine investigations for the major burns patient

Routine baseline bloods should be ordered including:

- *FBC (full blood count) and CRP (C-reactive protein)*: Act as a baseline level.

- *Renal function*: Huge fluid losses can occur in major burns with resultant electrolyte imbalances and AKI (acute kidney injury).
- *Group and screen with clotting*: All trauma patients may require transfusion.
- *Carboxyhaemoglobin*: Identify carbon monoxide (CO) poisoning.
- *Arterial blood gas (ABG)*
  - To establish baseline PaO_2, $PaCO_2$, lactate and any acid-base abnormalities that may indicate hypoxia.
- *CXR*
  - To look for any radiological evidence of inhalation injury, associated chest injuries or the development of acute respiratory distress syndrome (ARDS – diffuse bilateral pulmonary infiltrates seen on CXR).
- *Urine output*
  - Patients with major burns can develop hypovolaemic shock. Insertion of a urinary catheter to monitor hourly urine output is important in reliably assessing patient's circulating blood volume. Aim for greater than 0.5 mL/kg/hour with fluid resuscitation.

Management of minor burns

Superficial epidermal burns do not usually require dressings and should be kept clean. Once the skin is well healed, topical emollients such as aqueous cream can be used to help prevent scarring.

Superficial partial thickness burns usually require more treatment and it is important to ensure the following is carried out:

- Ensure adequate analgesia. Follow the WHO pain ladder – starting with non-opioids (e.g. paracetamol 1 g PO QDS), before adding weak opioids (e.g. codeine 30–60 mg PO QDS).
- *Administer basic first aid*: Irrigate the burn with cool sterile water (or running tap water if not available) for 20 minutes.
- Small blisters <1 cm in diameter can be left intact, whilst large tense blisters over joints should be de-roofed, by removing the top layer of dead skin under sterile conditions. Clinical photographs in the patient notes are useful at this stage prior to dressing.
- Apply non-adherent dressings such as paraffin gauze (e.g. Jelonet dressing) or silicon (e.g. Mepitel dressing). Dressings should be reviewed after 48 hours to reassess the burn for evidence of wound healing or infection.

- If the burn becomes infected then antibiotics should be commenced with daily wound review and dressings after sending wound swabs for culture.
- See subsection 'Referral to a specialist burns centre'.

Management of major burns

In major burns (>15% TBSA in adults or >10% in children) the use of systematic primary and secondary surveys are useful in identifying and treating life-threatening injuries and illnesses.

Primary survey

Airway

Upper airway oedema and obstruction can result from either direct thermal injury to the upper airway or through the inhalation of toxic fumes. Clinical signs suggestive of an inhalation injury include:

- Burns to face or neck.
- Evidence of erythema, blistering or swelling in the oropharynx.
- Singed nasal hair or eyebrows.
- Carbonaceous sputum.
- Reduced GCS (Glasgow Coma Scale) due to CO inhalation.
- Increased respiratory effort.
- Hoarse voice.
- Added sounds (e.g. wheeze) on auscultation.

If there is any suspicion of an inhalation injury early assessment by an anaesthetist is essential, as the patient may require endotracheal intubation. This should be undertaken early if suspected before oedema prevents airway access.

> **Tip:** Stridor is an indication for immediate endotracheal intubation.

Breathing

High flow oxygen (10–15 L/minute) via a non-rebreathe mask should be applied as soon as possible to prevent hypoxia. An ABG should be performed.

Circulation

Intravenous access should be obtained with two large bore cannulae (12–14 G) in the ante-cubital fossa.

Disability

CO poisoning results from the exposure to fire and can present with confusion and drowsiness. Other symptoms include headache, dizziness, visual disturbance, nausea and vomiting.

CO has a much greater affinity for binding to haemoglobin than oxygen, and blood carboxyhaemoglobin levels over 60% are likely to result in death. High flow oxygen is the mainstay of treatment (until symptom-free and levels <10%). In some cases hyperbaric oxygen therapy may be indicated, however this should not be started without specialist input.

Exposure

It is important to remove all clothing from patients – adherent synthetic clothing should be actively cooled with water, and left for formal debridement.

Fluid resuscitation and analgesia

Adults with partial or full thickness burns affecting over 15% TBSA and children over 10% TBSA require intravenous fluid therapy to replace fluid losses and maintain a good urine output; 0.5–1 mL/kg/hour in adults and 1–2 mL/kg/hour in children. The fluid requirement is calculated using Parkland's formula previously.

Intravenous analgesia and opiates are often required for adequate pain relief – IV paracetamol 1 g QDS in patient >50 kg, and IV morphine, initially 2.5mg–5 mg, titrating dose to the severity of pain and patient response. Monitor for signs of opioid toxicity including respiratory depression. Naloxone can be used to reverse the effects of opioids (given IV 400 μg, repeated after 1 minute if no response).

Secondary survey

The secondary survey should include:

- Head to toe examination
- Clinical photography
- Wound swabs (MC&S [microscopy, culture and sensitivity])
- Clean wounds with sterile normal saline

- Dressings
- *Tetanus prophylaxis*: 500 units of tetanus immunoglobulin to be given IM to any patient with burns causing a significant degree of devitalised tissue, regardless of their tetanus immunisation history.
- Nil-by-mouth
- Urinary catheter, nasogastric tube (where necessary)

> Note:
>
> Topical or systemic antibiotics are not routinely given for burn injuries. Early enteral nutritional therapy improves clinical outcome and survival.

Burn management

To provide adequate cooling, burns should be irrigated with cool sterile water for a period of at least 20 minutes. Very cold water and ice should be avoided as they can worsen tissue ischaemia through vasoconstriction.

Dressings can be used to help alleviate pain and keep the area clean. Paraffin gauze dressings (e.g. Jelonet) can be used for superficial burns, while silver-based dressings are preferred for deeper burns.

Partial thickness and full thickness burns will usually require surgery to prevent significant scarring and contracture formation. Surgery usually involves wound debridement and skin grafting by the plastic surgeons.

Referral to a specialist burns centre

Advice should be sought for the following injuries:

- Burns ≥5% TBSA in children or ≥10% in adults.
- Full thickness burns of any size, in any age group.
- All circumferential burns.
- Burns involving the face, hands, feet, perineum or genitalia.
- Any chemical or electrical burn.
- Suspicion of non-accidental injury (NAI).
- Burns in patients with significant co-morbidity.

Chemical burns

Chemical burns can result from exposure to strong acid or alkali agents found in both industrial and household products.

Initial treatment for chemical burns involves dilution of the chemical through continuous irrigation with water. This should be continued for at least 20 minutes or until pain settles and pH testing of the affected area is neutral (~pH 7.5). Do NOT attempt to neutralise the caustic agent.

Specialist advice should be sought for chemical burns urgently from the local specialist burn centre.

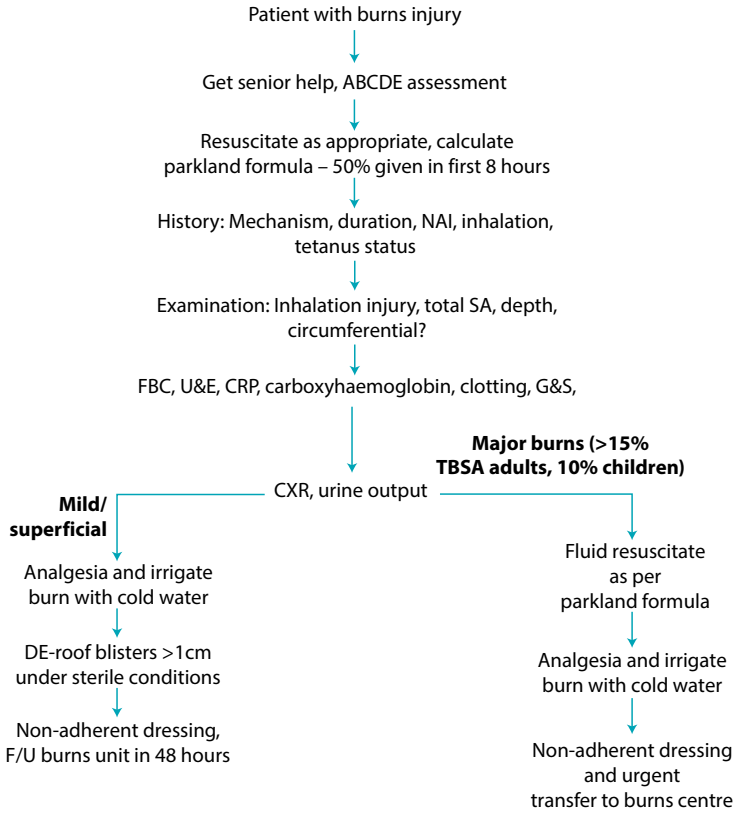
Electrical burns

Electrical injuries can be categorised into low (<1000 V) and high voltage (>1000 V). They are often more serious than they appear and can be associated with:

- Myocardial injury, arrhythmias and cardiac arrest.
- Compartment syndrome.
- *Rhabdomyolysis and subsequent acute kidney injury*: Creatinine kinase (CK) is a useful marker of muscle damage.

Electrocardiogram (ECG) is essential for all electrical burns, with cardiac monitoring being indicated for more serious cases.

Summary algorithm


Patient with burns injury
Get senior help, ABCDE assessment
Resuscitate as appropriate, calculate parkland formula – 50% given in first 8 hours
History: Mechanism, duration, NAI, inhalation, tetanus status
Examination: Inhalation injury, total SA, depth, circumferential?
FBC, U&E, CRP, carboxyhaemoglobin, clotting, G&S,
CXR, urine output
Mild/ superficial
Major burns (>15% TBSA adults, 10% children)
Analgesia and irrigate burn with cold water
DE-roof blisters >1cm under sterile conditions
Non-adherent dressing, F/U burns unit in 48 hours
Fluid resuscitate as per parkland formula
Analgesia and irrigate burn with cold water
Non-adherent dressing and urgent transfer to burns centre

Key questions to ask over the phone when being referred a burn injury:

1. What type of burn has the patient sustained?
2. Is there a concern over inhalation injury?
3. What is the total surface area of the burn?
4. What is the depth of burn?
5. Has the patient been cannulated and IV fluids commenced and tetanus booster given?
6. Is the patient exhibiting any signs of hypovolaemic shock?

Taylor & Francis
Taylor & Francis Group
http://taylorandfrancis.com

Chapter 22
Head injuries

Humza T. Osmani

Head injuries include injuries to the scalp, cranium and brain, and account for approximately 10% of all presentations to the accident and emergency department. Up to half of these presentations are children under the age of 16.

The majority of head injuries do not require neurosurgical intervention. Furthermore, the majority will not have any long lasting effects. However, it is vital that those individuals who are high risk (e.g. on anticoagulation such as warfarin or an NOAC [novel oral anticoagulants]: rivaroxaban, apixaban, edoxaban, dabigatran), or who have sustained severe injuries are not missed.

Importantly, cervical spine injuries should not be missed when assessing those with head injuries.

The key points to consider in a head injury patient are:

- To assess the severity of the injury and whether a CT (computerised tomography) head is indicated.
- To ensure early neurosurgical input where imaging shows significant pathology.

History and examination

The specific details to elicit are:

- Any witnesses? Obtain a collateral history. Important where the patient demonstrates retrograde amnesia.
- Mechanism of injury:
  - Blunt or penetrating?
  - Was there loss of consciousness (LOC) prior to the event?
  - If it was secondary to a road traffic collision (RTC), were they wearing a helmet? Is the helmet broken?

- Illicit drugs or alcohol use prior to injury?
- Has there been any LOC or fluctuations in their Glasgow Coma Scale (GCS) since the injury?
- Any seizure(s) post injury? Obtain details.
- *Amnesia*: Retrograde (e.g. patient unable to answer questions regarding events prior to head injury) and/or anterograde (e.g. patient unable to answer questions regarding events following head injury)? What is the duration of the amnesia?
- Did they vomit afterwards? If yes, how many times?
- Have they had similar injuries before or any previous neurosurgical interventions?
- Past medical history e.g. cardiovascular history including polycystic kidney disease (associated with intracranial aneurysms, known as a 'Berry aneurysm'), dementia and degree of deficit (atrophic brain tissue), alcoholism, thrombophilia, epilepsy.
- Medications, especially anticoagulants, antiplatelets and allergies.
- Social history including alcohol, smoking and recreational drug use.
- Time of their last meal.

Where GCS is reduced, or the patient has had a period of amnesia, a collateral history is vital.

As part of a full examination, focus on:

- Primary survey:
  - Follow ATLS (advanced trauma life support) guidelines, remembering an ABCDE (airway, breathing, circulation, disability, exposure) approach and do NOT forget C-spine.
  - Calculate GCS (see Table 22.1) and examine pupils as part of 'D.' If the GCS is 8 or below, the patient should be intubated as they will not be able to maintain a patent airway. The anaesthetist should be present at the trauma call as part of the trauma team, so you should not be required to manage the airway but should be aware of the importance of establishing a definitive airway early.
  - Unilateral pupillary dilation suggests ipsilateral intracranial bleeding causing temporal lobe herniation and compression of the oculomotor nerve (CN III) against the tentorium, particularly if this is associated with contralateral hemiparesis and reduced GCS.

Table 22.1 The Glasgow Coma Scale and Score

	Eyes	Voice	Motor
1	Does not open eyes	Makes no sounds	Makes no movements
2	Opens eyes in response to a painful response	Incomprehensible sounds	Extension to painful stimuli (decerebrate)
3	Opens eyes in response to voice	Utters inappropriate words	Abnormal flexion to painful stimuli (decorticate)
4	Opens eyes spontaneously	Confused, disoriented	Flexion/withdrawal to painful stimuli
5	–	Oriented, converses normally	Localises to painful stimuli
6	–	–	Obeys commands

Glasgow Coma Scale

- Document this as a total score and its component parts e.g.
  - GCS 15/15 – (E4, V5, M6)
  - This clearly shows where the deficit is, if one is present

Score interpretation:

- *Minimum score*: 3/15 – (E1, V1, M1)
- *Maximum score*: 15/15 – (E4, V5, M6)
- *Mild injury*: 14–15
- *Moderate injury*: 9–13
- *Severe injury*: <8

Secondary survey

- Assess for cranial injuries e.g. depressed skull fracture or haematomas.
  - Signs of a basilar skull fracture include cerebral spinal fluid (CSF) otorrhea/rhinorrhea, 'raccoon or panda eyes' and Battle's sign (bruising over mastoid process).
- Perform a full cranial nerve examination.

Perform a full peripheral limb neurological examination with inspection, tone, power, reflexes, sensation and coordination for a deficit suggestive of an upper motor neurone (UMN) or lower motor neurone (LMN) lesion (see Table 22.2).

- For both upper and lower limbs, record your findings clearly. Sometimes a simple diagram is the easiest way to do this. The authors suggest using a simple table comparing left and right arms and legs as shown in Table 22.3. We have specified the expected findings for an UMN or LMN lesion in Figure 22.1.

Table 22.2 Peripheral Limb Neurological Limb Examination Findings

	No lesion	UMN	LMN
Inspection: Muscle atrophy	None	None (muscle atrophy may be present in UMN lesions in the chronic setting from disuse atrophy)	Present
Inspection: Muscle fasciculation	None	None	Present
Tone	+ Normal	++ Increased (spasticity)	– Reduced (flaccid)
Power	MRC (Medical Research Council) Grade 0–5 0: No contraction 1: Flicker of movement 2: Active movement; gravity eliminated 3: Active movement; against gravity 4: Active movement; against gravity and resistance 5: Normal power (Reduced power can be due to an UMN or LMN lesion)		
Reflexes	+ Normal	++ Hyperreflexia	– Hyporeflexia
Babinski reflex	– Absent (normal in infants)	+ Present	– Absent

Table 22.3 Template for Recording Peripheral Limb Neurological Exam Findings

	Upper Limbs	
	Right	**Left**
Inspection		
Tone		
Power Shoulder abduction C5 Elbow flexion C5/6 Elbow extension C7 Wrist extension C7 Finger extension C7 Wrist flexion C8 Finger flexion C8 Finger abduction T1		
Reflexes Brachioradialis C6 Biceps C5 Triceps C7		
Babinski Reflex		
Sensation[a] Fine Pinprick		
Proprioception[b]		
Vibration[b]		
	Lower Limbs	
Inspection		
Tone		
Power Hip flexion L1/2 Hip extension L5/S1 Knee extension L3/4 Knee flexion L5/S1 Ankle dorsiflexion L4 Ankle plantarflexion S1 Extensor hallucis longus L5		

(*Continued*)

Table 22.3 (*Continued*)

	Lower Limbs	
Reflexes Ankle S1/2 Knee L3/4		
Babinski Reflex		
Sensation[a] Fine Pinprick		
Proprioception[b]		
Vibration[b]		

[a] Define level if deficit present
[b] Move proximally to next large joint to identify normal level

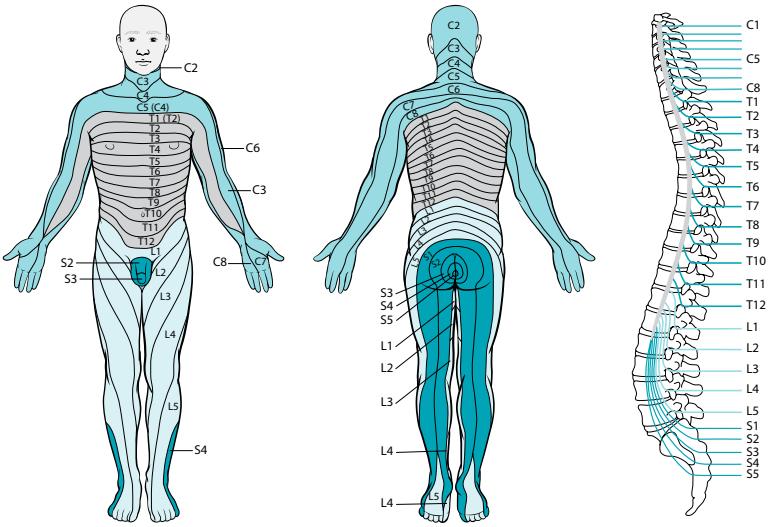


Figure 22.1 Spinal dermatomes, helpful for the determination of sensory level.

Routine investigations

Routine bloods should be ordered including:

- *FBC (full blood count)*: Hb is unlikely to fall greatly with an intracranial bleed (cranium is a fixed space), however, it is important to document this pre-op and monitor Hb in the polytrauma patient.

- *Clotting*: To assess the risk of further bleeding. An INR (international normalized ratio) level is particularly important in a patient who has a reduced GCS and is on warfarin. The clotting may be normal in a patient who is taking an NOAC and correction would need urgent discussion with the on-call haematology registrar in the presence of an intracranial haemorrhage.
- *Urea and electrolytes (U&E)*: To assess renal function for any further contrast-enhanced scans that may be necessary.
- *Group and save*: Important in polytrauma patients or if the patient is going to theatre.
- *VBG (venous blood gas)*: To assess lactate and base deficit levels as indicators of adequate resuscitation in the trauma patient.
- *ECG (electrocardiogram)*
  - Useful as a baseline and to assess for a possible cardiac event or arrhythmia as the underlying cause for a fall or syncopal episode leading to the head injury (if suggested by the history). A normal ECG does not exclude arrhythmia and if the history is suggestive, further investigation is warranted.
- *Chest XR (X-ray)*
  - To assess for other injuries and for pre-operative assessment.
- *Pelvic/hip XR*
  - Consider other imaging to exclude fracture in the context of a fall. Ensure that there are no concurrent injuries.
- *CT head*
  - CT scans are easily available and in the acute setting do not require contrast. Whilst a senior doctor will most likely decide to perform a CT head, it is important to be aware of the key signs and symptoms which indicate a CT head (as recommended by NICE [National Institute for Health and Care Excellence]):

Adults

A CT head scan should be performed *within 1 hour* in any patient with:

- GCS <13 on arrival during initial assessment
- GCS <15 after 2 hours of injury
- Post-traumatic seizure
- Any focal neurological deficit (document these clearly on the request)
- >1 episode of vomiting

- Suspected depressed or open skull fracture
- Signs of basal skull fracture: Battle's sign, haemotympanum, panda/raccoon eyes, CSF rhinorrhoea or otorrhoea

A CT head scan should be performed *within 8 hours* in any patient with LOC or amnesia since injury, who also has any one of the following features:

- Aged 65 years or older
- Known bleeding or clotting abnormalities
- Over 30 minutes of retrograde amnesia regarding the events immediately prior to the head injury
- *Mechanism of injury*: Serious e.g. fall from height of >1 m or 5 stairs; pedestrian or cyclist hit by a vehicle

Children

A CT head scan should be performed *within 1 hour* if any of these are present:

- Non-accidental injury suspected
- Post-traumatic seizure (with no history of epilepsy)
- GCS <14 on arrival
- GCS <15 after 2 hours of the injury
- Tense fontanelle or suspected open or depressed skull fracture
- Focal neurological deficit (document these clearly on the request)
- Signs of basal skull fracture (as per adults)
- Children <1 years old:
  - Bruising, swelling or laceration >5 cm
  - GCS <15 on arrival

A CT head scan should be performed within 1 hour if *more than one* of these features is present:

- Witnessed LOC for >5 minutes
- Abnormal drowsiness
- Three or more episodes of vomiting
- *Amnesia*: Retrograde or anterograde, lasting >5 minutes (this will be difficult to confirm in <5 year olds)
- *Mechanism*: Dangerous i.e. high speed RTC or falls from height >3 m

Children with head injuries where only one of these risk factors is present should be observed for 4 hours. However, if any of the following develop during observation, perform a CT scan within 1 hour:

- GCS <15
- More episodes of vomiting
- Abnormal drowsiness episode

Patients on warfarin

If a patient is on warfarin and has sustained a head injury but has none of the above indications, a CT head scan should be performed within 8 hours.

Intracranial lesions

There are a number of important CT findings that need to be discussed with the neurosurgeons (see Figure 22.2 illustrating types of intracranial haematoma) as follows.

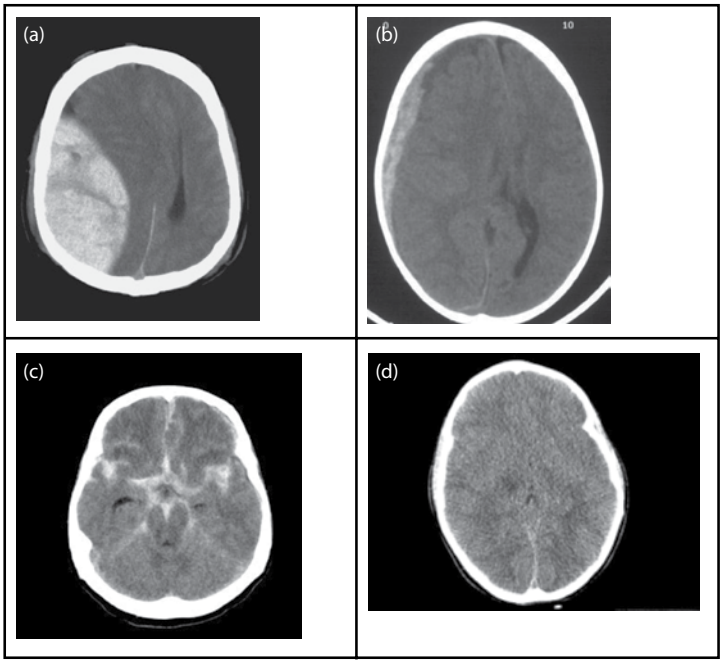


Figure 22.2 (a) Extradural (typically lentiform shaped), (b) subdural (typically crescent shaped), (c) subarachnoid haemorrhage (hyperattenuating material in the subarachnoid space) and (d) diffuse axonal injury (typically small petechial haemorrhages are seen throughout).

Diffuse axonal injury

Represent nearly 50% of all severe head injuries. Secondary to traumatic shearing forces across axons. This commonly occurs in vehicle accidents due to severe deceleration. CT may initially appear normal, or the brain diffusely swollen with loss of grey-white matter differention. Multiple punctate haemorrhages throughout the cerebral hemispheres, particularly at the white-grey matter interface (e.g. at the corpus callosum) can take time to manifest. Loss of conscious at the initial accident and prolonged coma with variable outcomes are characteristic.

Concussion: Whilst this is classified as a 'minor traumatic brain injury', a CT head may be performed if any of the aforementioned criteria are met to rule out intracranial bleeds.

Subarachnoid haemorrhage

Blood is present between the arachnoid mater and pia mater. Traumatic causes can occur in any age group, whilst rupture of aneurysms tends to occur in patients under 60. Patients describe a sudden, severe headache ('thunderclap' headache), and this can be associated with vomiting episodes and neck stiffness, which can be confused for meningitis. A non-contrast CT head is highly sensitive and blood appears most commonly in the cerebral sulci in traumatic cases.

Extradural haematoma

Blood is present between the dura mater and the periosteum. This is commonly due to injury to the middle meningeal artery in a young patient who has been punched over the pterion (where the frontal, temporal, parietal and sphenoid bones meet, on the side of the temple). The patient is usually young and witnesses describe a 'lucid interval' after the initial trauma. CT demonstrates a biconvex lens but beware of the 'mass effect' and midline shift.

Subdural haematoma

Blood is present between the dura mater and the arachnoid mater. Bleeding is secondary to injury to the bridging veins. The patient is usually elderly and has had a fall. Witnesses describe the onset of an increasingly gradual confusion. CT demonstrates a crescent-shaped hyperdense collection.

Contusion

This is a bruise of the brain tissue and is present in 20%–30% of severe brain injuries. Contusions can coalesce over time with mass effect and

raised intracranial pressure or evolve into an intracerebral haematoma that may require neurosurgical intervention. Interval scanning (24–48 hours) is therefore advised.

Cranial injuries

- Open and closed vault fractures or where there is bone depression
- Base of skull fractures

Tip: Ensure you look for signs of CSF leakage (otorrhoea, rhinorrhoea)

Specialist investigations following discussion with seniors

- MRI scan
  - Neurological signs or symptoms attributable to C-spine injuries may warrant an MRI. Specifically, an MRI can be helpful in patients with suspected vascular head injuries as it offers high-resolution structural imaging and is able to assess perfusion, tissue status and vascular patency (angiography).

Specific scenarios

A patient has been hit on the head with a baseball bat and has presented with a GCS of 13. An external scalp laceration and haematoma is present. The patient has vomited twice since the injury.

This patient should be seen urgently due to the reduced GCS, mechanism of injury and vomiting episodes.

- Assess the patient in an ABCDE manner, maintaining C-spine stability.
- Insert ×2 wide-bore (12–14 G) cannulas and send for routine blood tests including VBG. Start fluid resuscitation.
- Keep nil-by-mouth in case neurosurgical intervention is required.
- Order an urgent CT head as per NICE guidelines.
- Before sending the patient to the CT room, repeat a full primary survey to ensure there are no other life-threatening injuries.
- Discuss the patient with the neurosurgeons when the CT has been performed. Do not wait for the formal report to have this discussion.

The CT scan may demonstrate an intracranial bleed, which will definitely need to be discussed with neurosurgeons. If it does not demonstrate a bleed, discussion with the neurosurgeons is still required due to the mechanism of injury, the reduced GCS and the episodes of vomiting. Advice will be required regarding how long the patient should be observed for and to develop a clear escalation plan if necessary.

Document the discussion and plan clearly in the notes.

NICE recommend that referrals to neurosurgeons should ALWAYS be made in head injuries where any of the following are present:

- GCS of 8 or less
- Deteriorating GCS
- Progressive focal neurological deficits
- Penetrating injury (confirmed or suspected)
- CSF leak (otorrhoea, rhinorrhoea)
- Seizure without full recovery
- Confusion lasting >4 hours which is unexplained

A 25-year-old female who was involved in an RTC (cyclist hit by van). She was wearing a helmet and landed on the pavement. She lost consciousness briefly but remembers the event. She feels nauseous and has a severe headache. Her GCS has been 15 throughout.

- Assess the patient in an ABCDE manner, maintaining C-spine stability.
- Ensure there are no other injuries e.g. long bones (secondary survey once primary completed).
- She requires a CT head and C-spine (at least) within 8 hours due to the mechanism of injury and associated LOC.
- Assess the laceration to see whether it requires formal debridement, washout or closure.

Although this patient's GCS is 15, the mechanism of injury warrants a CT head and at least 8 hours of observation. Importantly, the patient should only be discharged provided:

1. The CT head reveals no pathology.
2. There is complete resolution of symptoms/signs.

3. A responsible adult is available to supervise the patient for the following 24 hours.

Discharge advice (written and verbal) should always be provided. Written forms should include information about their injury and recovery (including return to work and sports); important contact numbers and instructions to return if any of the following develop:

- Increasing drowsiness
- Confusion
- Two or more further episodes of vomiting
- Worsening headache
- Dizziness
- Visual problems (e.g. blurring)
- Limb weakness
- Blood or 'clear fluid' (CSF) discharge from their ear or nose
- Unusual breathing

NICE recommend a period of observation should ALWAYS be performed in the following scenarios:

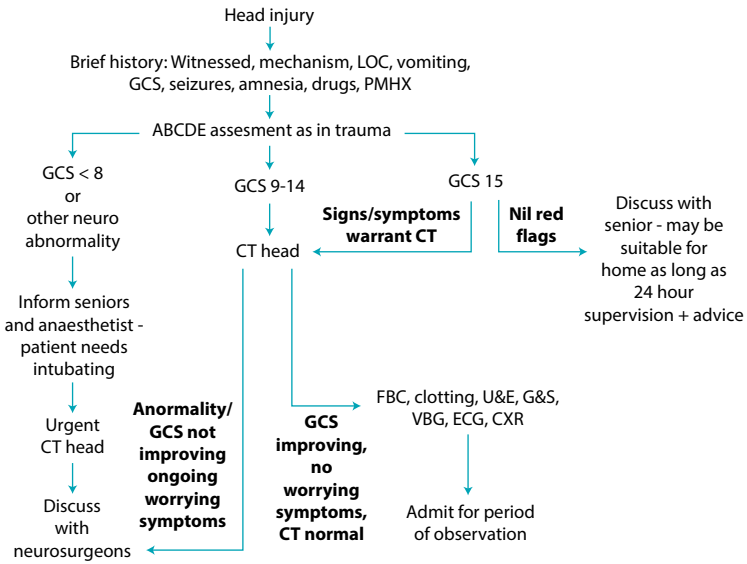
- Significant abnormalities on imaging.
- A GCS which has not returned to 15 (irrespective of imaging results).
- Where a CT head is warranted but cannot be performed due to the CT being unavailable or the patient being uncooperative.
- Worrying persistent clinical signs e.g. vomiting, severe headache.
- Other aspects of the history/clinical examination which worries the clinician e.g. alcohol or drug use, non-accidental injury, other injuries.

Neurological observations should be performed every 30 minutes until the GCS is 15.

Once GCS is 15, neurological observations should be performed every 30 minutes for 2 hours; every 1 hour for 4 hours and finally, every 2 hours thereafter.

Observations should return to every 30 minutes if the GCS deteriorates below 15 at any time after the initial 2 hour period. If new signs/symptoms develop or the GCS falls, contact the neurosurgeons (and prepare to repeat the CT).

Summary algorithm


Head injury
Brief history: Witnessed, mechanism, LOC, vomiting, GCS, seizures, amnesia, drugs, PMHX
ABCDE assesment as in trauma
GCS < 8 or other neuro abnormality
GCS 9-14
GCS 15
Signs/symptoms warrant CT
Nil red flags
Discuss with senior - may be suitable for home as long as 24 hour supervision + advice
CT head
Inform seniors and anaesthetist - patient needs intubating
Urgent CT head
Discuss with neurosurgeons
Anormality/ GCS not improving ongoing worrying symptoms
GCS improving, no worrying symptoms, CT normal
FBC, clotting, U&E, G&S, VBG, ECG, CXR
Admit for period of observation

Key questions to ask over the phone when being referred a head injury which will make your time on-call easier:

1. What is the GCS? Is this stable or deteriorating?
2. If 8 or less, is the anaesthetist aware?
3. Are there any focal neurological deficits/signs of CSF leak/meningism?
4. Has the patient vomited/had a seizure?
5. Has a CT head been performed?
6. Have the neurosurgeons been informed?

Part VI

Skin

Taylor & Francis
Taylor & Francis Group
http://taylorandfrancis.com

Chapter 23

Necrotising fasciitis and Fournier's gangrene

Alexander Martin

Necrotising fasciitis is a rapidly progressive infection of superficial soft tissues and fascial planes. With only 500 estimated new cases in the UK per year, necrotising fasciitis is a rare clinical entity. However, mortality rates have been reported to be as high as 30%. Therefore, despite the low incidence, all clinicians must maintain a high index of suspicion in order to avoid overlooking this potentially deadly diagnosis.

Fournier's gangrene is necrotising fasciitis that is localised to the perineum and scrotum. The pathophysiology, treatment and potential outcomes are the same as for necrotising fasciitis, and the two conditions have been considered together in this chapter.

Necrotising fasciitis can be categorised into two broad types according to the causative microorganisms.

- Type 1 is polymicrobial and comprises infection with both anaerobic (e.g. Clostridium, Bacteroides) and facultative anaerobic (e.g. Escherichia *coli*, Enterobacter) microorganisms. Together these organisms act synergistically to cause rapidly progressive massive soft tissue infection. Type 1 necrotising fasciitis is most common and accounts for approximately 80% of cases.
- Type 2 is caused by group A streptococci in isolation, though occasionally *Staphylococcus aureus* infection may coexist.

Necrotising fasciitis is characteristically a deep seated soft tissue infection that tracks along fascial planes and soft tissue layers. The causative microorganisms produce exotoxins and enzymes responsible for tissue destruction, small vessel thrombosis and liquefactive necrosis. Fascial and soft tissue planes provide routes of spread with minimal resistance and accordingly tissue necrosis can extend quickly. Early in the disease process overlying skin may remain entirely normal although inflammatory changes may result in erythema and oedema. Deep subcutaneous nerve involvement classically causes a period of severe pain, out of proportion to clinical findings, followed by eventual

numbness representing nerve destruction. Skin changes typically remain subtle until extensive destruction and necrosis of subcutaneous fat and fascial planes have occurred. Eventually skin cyanosis, necrosis and ulceration occur. Untreated, necrotising fasciitis causes widespread tissue destruction and overwhelming sepsis.

Distinguishing necrotising fasciitis from cellulitis is key to appropriate and timely management. Histologically the difference is clear. Cellulitis is an infection arising at the junction of the superficial fascia and the dermis, whilst necrotising fasciitis is an infection arising at the level of the deep fascia and subcutaneous fat (see Figure 23.1).

Clinical differentiation between cellulitis and necrotising fasciitis is less straightforward and therefore a high index of suspicion for necrotising fasciitis must be maintained in any patient presenting with an apparent superficial soft tissue infection.

The key points to consider in necrotising fasciitis admissions are:

- Early diagnosis and urgent management which are key to survival.
- To urgently resuscitate and escalate the patient for surgical debridement.

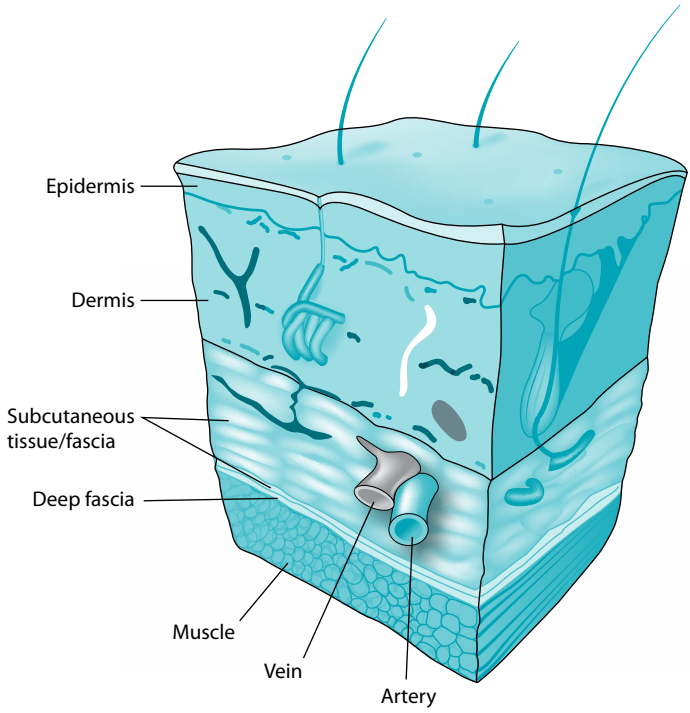


Figure 23.1 Layers of skin

History and examination

The specific details to elicit are:

- Assess the location and nature of symptoms. In the early stages patients may present with a focal area of swelling or 'fullness'. Pain out of proportion to clinical findings is an important feature to illicit.
- Identify the presence of systemic symptoms to suggest sepsis. Ask about fever, light-headedness, palpitations and malaise.
- Determine the duration of symptoms. Patients presenting with significant clinical findings and a short history require more urgent intervention.
- Identify the likely cause. Recent surgery, soft tissue injury or insect bite may identify a route of infection. However, note that in some cases there is no preceding traumatic event.
- Ask about risk factors:
  - Diabetes mellitus
  - Peripheral vascular disease
  - Chronic kidney disease (CKD)
  - Malignancy
  - Alcoholism
  - Smoking
  - Human immunodeficiency virus (HIV)
  - Immunosuppressive therapy (systemic corticosteroids, methotrexate, chemotherapy)
  - Obesity
  - Recent surgery
  - *Trauma*: Soft tissue injuries, insect bites, etc.

As part of a full examination focus on:

- Is the patient demonstrating signs of sepsis (pyrexia, tachycardia or hypotension)? (See Chapter 8 for more details.) Immunocompromised patients may not mount a classical response to infection.
- Assess the patient's fluid balance. Septic patients will have high rates of insensible fluid losses and will likely require aggressive intravenous fluid resuscitation.
- Look for peripheral stigmata that might suggest risk factors for necrotising fasciitis, e.g. signs of vascular disease or diabetes mellitus in the feet (ulcers, colour changes, scars).
- Intravenous drug use marks
  - Lipohypertrophy (suggestive of long-standing insulin use)
  - Malnutrition
  - Cushingoid features (resulting from chronic corticosteroid use)

- Inspect and palpate the affected region. Assess for erythema, swelling, blisters, subcutaneous emphysema, skin necrosis, ulceration. Exquisite tenderness to palpation in the absence of hard clinical findings is a common feature.
- Accurately demarcate and record the affected area. This is essential in order to closely monitor for rapid progression and extension of infection.

Tip: Remember: Necrotising fasciitis is a clinical diagnosis.

Routine investigations

Routine bloods should be ordered including:

- *FBC (full blood count) and CRP (C-reactive protein)*: WCC (white cell count) and CRP will be elevated in most cases. However, be aware that inflammatory markers may lag behind clinical features.
- *Renal function and creatine kinase (CK)*: CK may be raised representing tissue destruction. Acute kidney injury (AKI) may ensue as part of the severe sepsis that can develop.
- *Blood cultures*: Immediate blood cultures should be obtained, prior to commencement of antibiotic therapy (which should be given immediately after, see paragraph relating to antibiotics).
- *Lactate*: As part of the 'sepsis bundle' a VBG (venous blood gas) should be obtained to determine venous lactate.
- *Group and save with clotting*: The patient will require theatre urgently and should have a group and screen in case of significant blood loss. Unwell patients with severe sepsis may be coagulopathic and/or develop disseminated intravascular coagulopathy (DIC).
- *ECG (electrocardiogram)*
  - This should be performed on all unwell patients on presentation, especially those who may require surgery and general anaesthesia.
- *Pus swab*
  - Areas of ulceration or pus exudation should be swabbed and sent for microscopy, culture and sensitivities (MC&Ss), in order to help guide early antimicrobial therapy. Broad spectrum parenteral antibiotics should be started emergently. All suspected cases of necrotising fasciitis should be discussed with the on-call microbiology team. Cover for aerobic and anaerobic microorganisms is required (e.g. ciprofloxacin 400 mg IV BD, clindamycin 600 mg IV QDS and benzylpenicillin 1.2 g IV 4 hourly), though specific antibiotic regimens differ according to local policy.

Specialist investigations following discussion with seniors

As mentioned, the diagnosis is clinical. If you have any suspicion of the diagnosis, arrange for an urgent senior review and prepare the patient for theatre as these patients often require extensive life-saving skin/soft tissue debridement. Specialist investigations are therefore rarely performed unless the diagnosis is considered unlikely.

- Computed tomography (CT)
  - CT scanning can help identify fascial thickening, inflammatory subcutaneous tissue stranding and the presence of focal fluid collections and gas. It can also help exclude alternative or coexistent pathology such as intra-abdominal collections.
- Magnetic resonance imaging (MRI)
  - MRI provides a more detailed imaging modality of soft tissue structures and enables differentiation between cellulitis and necrotising fasciitis. Limited availability and the duration of MRI scanning make this a rarely used investigation.

Specific scenarios

An obese 42-year-old man with a history of diabetes presents with sepsis. His right leg is swollen and red, and there is evidence of an insect bite on his calf that occurred 2 days ago. He is confused and the leg is severely painful.

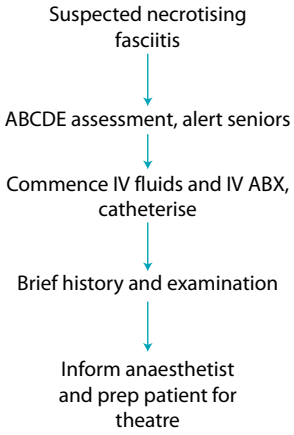
Necrotising fasciitis is a true surgical emergency and definitive treatment involves systemic antimicrobial therapy and emergent aggressive surgical debridement of all necrotic tissue. Early senior input from the general surgical, intensive care, anaesthetic and microbiology teams are essential.

- Assess and resuscitate using ABCDE (airway, breathing, circulation, disability, exposure) approach.
- Request urgent senior review.
- Insert ×2 wide-bore (12–14 G) cannulas, send blood for culture and routine tests, then commence IV fluids and IV broad spectrum antibiotics (discuss the choice with the on-call microbiologist).
- Catheterise the patient and monitor fluid balance closely.
- Prepare the patient for theatre.

Definitive treatment of necrotising fasciitis is via aggressive surgical debridement of all necrotic tissue and drainage of focal collections. Tissue

samples must be sent for MC&S in order to guide antibiotic therapy. Subsequent re-look and further debridement operations are indicated at 24–72 hourly intervals until a healthy wound bed is achieved. Subsequent wound management often requires input from tissue viability and plastic surgery teams.

Summary algorithm


Suspected necrotising fasciitis
ABCDE assessment, alert seniors
Commence IV fluids and IV ABX, catheterise
Brief history and examination
Inform anaesthetist and prep patient for theatre

Key questions to ask over the phone when being referred necrotising fasciitis which will make your time on-call easier:

1. Has senior support been requested? Are they on the way?
2. Has the patient been cannulated and IV fluids or antibiotics started?
3. What were the blood results including VBG?
4. Is the patient exhibiting signs of sepsis? Review observations, bloods.

Chapter 24
Breast lump assessment

Jason Hol-Ming Wong

Breast cancer is the most common cancer in the UK and examining a breast lump is an important and essential skill for all junior doctors working in surgical rotations. One in eight women in the UK develop breast cancer at some point in their lifetime, with roughly 50,000 women being diagnosed with invasive breast cancer each year in the UK.

The key points to consider when assessing a breast lump are:

- To offer a chaperone and record their name and occupation.
- To regard any breast lump as potentially malignant until proven otherwise.
- To ensure that appropriate investigations and follow ups are arranged.

History

The specific details to elicit are:

- Has the patient noticed a solitary or multiple breast lumps?
- Which breast is this in? Unilateral or bilateral?
- Any associated breast pain?
- Have there been any skin changes such as:
  - Dimpling
  - Indrawing
  - Eczema
  - Peau d'orange (skin appearance like orange peel)
- Have there been any nipple changes such as:
  - *Discharge*: Ask about the colour and presence of the blood
  - Retraction
- Any weight loss?

- Do they smoke? Identify the pack-year history.
- Do they have any risk factors for breast cancer such as:
  - Early menarche
  - Null parity or a late age when they had their first child
  - Late menopause
  - Prolonged hormone replacement therapy
  - Postmenopausal obesity
  - Smoking
  - Personal history of previous breast cancer, when this was, and how this was managed
- Is there a family history of:
  - Early onset breast cancer
  - Multiple cases of breast cancer in the family
  - Ovarian cancer
  - Male breast cancer

Examination

- Exposure:
  - Ask the patient to remove their shirt so that they are bare from the waist up and sitting upright.
- General inspection:
  - Ask the patient to relax and put their hands on their laps to relax the pectoralis muscles and perform a general inspection:
    - Look for any asymmetry in the breast or localised swelling
    - Assess for skin changes such as:
      - Dimpling
      - Indrawing
      - Eczema
      - Peau d'orange
- Look for nipple changes such as:
  - Paget's disease of the breast (eczema of the nipple/areolar complex)
  - Retraction
  - Destruction
  - Discharge
  - Ask the patient to push their hand into their hips to tense the pectoralis muscles and repeat the general inspection.
  - Ask the patient to put their hands behind their head and lean forward. Repeat the general inspection and look for any exacerbation of skin dimpling.
- Breast examination

- Ask the patient to lie at 45° on the bed and place their hands behind their head.

- Palpate each breast in turn (ALWAYS start with the normal side first):
  - Palpate the breast starting at the areola.
  - Work around the breast in an outward spiral to the upper outer quadrant, finishing at the axillary tail.

Tip: Use the pulp of your middle three fingers (not finger tips) to detect lumps

- Use the dorsum of your non-dominant hand to lift and inspect the underside of the breast. Then palpate the underside using your dominant hand.

- If a breast lump is found:
  - Palpate the lump between your thumb and index finger.
  - Feel for size, shape, consistency (is it fluctuant/firm) and mobility. Is the surface smooth or craggy?
  - Ask the patient to press their hands against their hips to tense their pectoralis muscles in order to assess whether the lump is attached to the deep structures (pectoralis fascia).

- Palpate the areola:
  - Ask the patient to squeeze their nipple to express discharge.
  - Ask them to massage around the breast to try to uncover any discharge.
  - If discharge is seen, make a note of the colour and consistency and if it is draining from one or more ducts.

- Axillary examination
  - When examining the patient's right axilla, ask them to rest their right arm on your right arm, and vice versa for the other side.
  - Palpate along the following areas for regional lymph nodes using your free hand (Figure 24.1):
    - Lateral thoracic wall
    - Medial humerus
    - Posterior wall of pectoralis major
    - Anterior wall of latissimus dorsi
    - Axilla
  - To complete your examination palpate the supraclavicular and cervical lymph nodes, perform a chest and abdominal examination (look for hepatomegaly), and feel for any spinal tenderness.

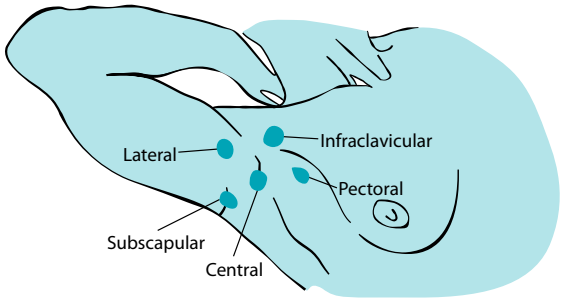


Figure 24.1 Lymph nodes: Lymphatic drainage of the body axillary lymph nodes.

Investigations

If a breast lump is identified the patient will require 'triple assessment' which consists of:

1. Clinical examination
2. Imaging
   - <40 years old – USS (due to fibro-dense breast tissue and minimise radiation exposure)
   - ≥40years old – Mammogram
3. Tissue sampling
   - Fine needle aspiration (for cytology)
   - Core biopsy (for histology)
     - This is dependent on service available (one-stop or two-stop clinic), however, core biopsy is ideal in order to obtain histology and therefore identify an invasive malignant process.

Specific scenarios follow

A 21-year-old woman presents at midnight to A&E (accident and emergency) department with a 4-month history of unilateral blood stained discharge from her left nipple. On examination there is nothing to note.

- Establish the degree of bleeding and examine the patient (maybe traumatic laceration).
- Enquire why the patient has presented now and not sooner? Address their ideas, concerns and expectations.

In this scenario you should refer the patient back to their GP (general practitioner) for further assessment. A referral (<2weeks) should be made to the specialist breast clinic for an urgent triple assessment.

Triple assessment comes back with no malignant cells on cytology and a diagnosis of intraductal papilloma.

Intraductal papilloma is the most common cause of blood stained nipple discharge, the next being adenocarcinoma. They are benign localised areas of epithelial proliferation within large mammary ducts. They increase the risk of developing invasive breast carcinoma and normally present with unilateral bloody discharge from the nipple. These patients are generally managed with microdochectomy (surgical removal of lactiferous duct and should be followed up by the responsible surgeon for histology results).

A 39-year-old woman presents with a mass in her right breast. Further examination identifies a 2.5 cm swelling in the upper inner quadrant of her right breast and a further 1.5 cm swelling in the central aspect of the same breast. She has right axillary lymphadenopathy.

This woman requires a target referral (<2 weeks) to the specialist breast clinic for triple assessment.

Core biopsies showed invasive ductal carcinoma in the breast and axilla.

A multidisciplinary team approach should be taken with this patient when formulating a management plan. As this patient has multifocal disease she will likely require a mastectomy and axillary nodal clearance. This may occur following chemotherapy with or without hormone therapy, which is dependent on her hormone receptor status (oestrogen, progesterone, and human epidermal growth factor receptor 2).

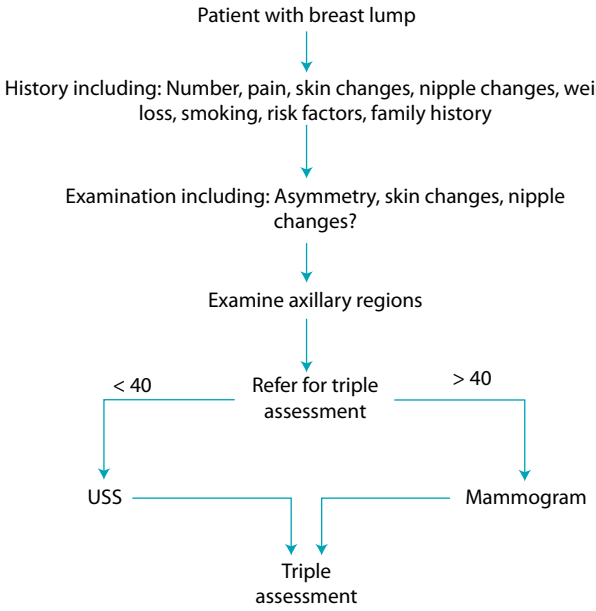
A concerned 18-year-old woman presents with a new right breast lump that she reports comes and goes with her menstrual cycle. Clinical examination is normal and there is no axillary lymphadenopathy.

- Establish the duration of her symptoms and any previous breast lumps or surgery. Has she started on any new medication such as the oral contraceptive pill?
- Is there anything that elicits the breast lump, such as after a hot bath?
- On clinical examination is it a distinct, mobile, smooth mass, known as a 'breast mouse'?

Breast lumps are common in women and it is important to differentiate between benign and malignant pathology. You must address the patient's ideas, concerns and expectations. Reassurance in this scenario is key, but if in doubt, discuss with your senior or breast surgeon. She either has increased breast fluid both before and during menstruation which could

represent itself as a lump, or a fibroadenoma. This is a benign, mobile lump, usually occurring in women less than 30 years old. It is formed of both breast and stromal tissue and is often a discrete lesion that may or not be palpable. In any case, a discussion should be made with the patient and the option of triple assessment should always be offered.

Summary algorithm



Part VII

Urological Disorders

Taylor & Francis
Taylor & Francis Group
http://taylorandfrancis.com

Chapter 25
Testicular lumps

Davoud Khodatars and Sarah Y. W. Tang

Testicular lumps can be characterised as cystic, inflammatory or solid. They are a common presenting complaint to the emergency department and require a thorough history and examination to ensure patients who need urgent surgical attention are not missed. Common causes of testicular lumps include:

- Testicular torsion
  - A twisting of the testis along the axis of the spermatic cord which causes it to compress its blood supply (Figure 25.1).
  - Characterised by sudden onset of severe pain.
  - Mainly affects boys aged 10–18.
- Malignancy
- Epididymitis
  - Inflammation of the epididymis often associated with orchitis.
  - Characterised by gradual onset of moderate pain and can be associated with pre-existing lower urinary tract symptoms.
  - Seen in boys and men of all ages.
- Orchitis
  - Inflammation of the testis often associated with epididymitis.
  - Characterised by gradual onset of moderate pain and can be associated with pre-existing lower urinary tract symptoms.
  - Seen in boys and men of all ages.
- Haematocele
  - Blood surrounding the testis.
  - Generally associated with trauma.
- Hydrocele
  - Fluid surrounding the testis.
  - Can be idiopathic or secondary to infection.

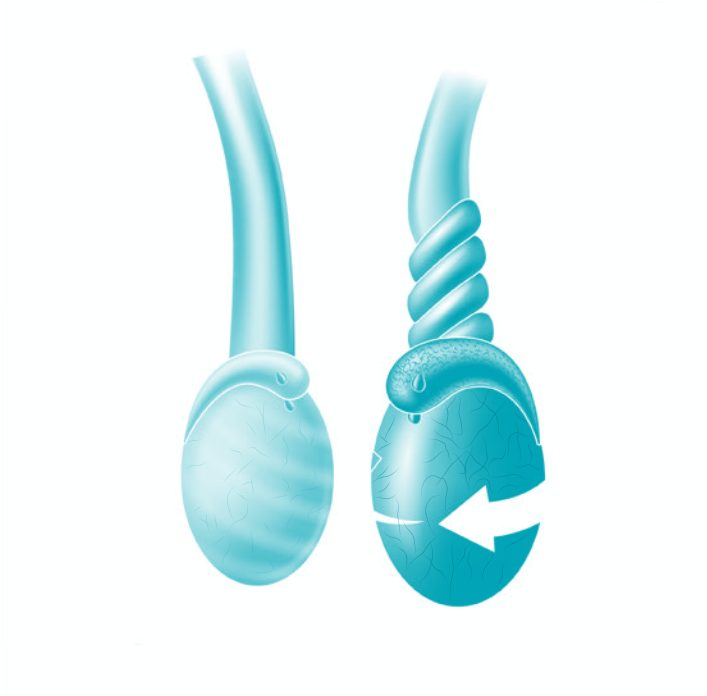


Figure 25.1 Testicular torsion.

- Varicocele
  - Dilated veins of the pampiniform plexus, said to look like 'a bag of worms' (Figure 25.2).
  - *Worsened by standing*: A left-sided varicocele that does not disappear on lying down may be a sign of a left-sided renal cancer which has invaded the renal vein, obstructing the drainage of the testicular vein, so an ultrasound of the kidneys is warranted if this is the case.
- Hernia
  - An indirect inguinal hernia can extend into the scrotum and present as a lump above and separate from the testis.

In patients presenting with testicular lumps the key points to consider are:

- Does the patient have testicular torsion and require immediate theatre?
- How severe is the pain and have they been given adequate analgesia?
- Does this patient need an acute admission or can they be managed as an outpatient?

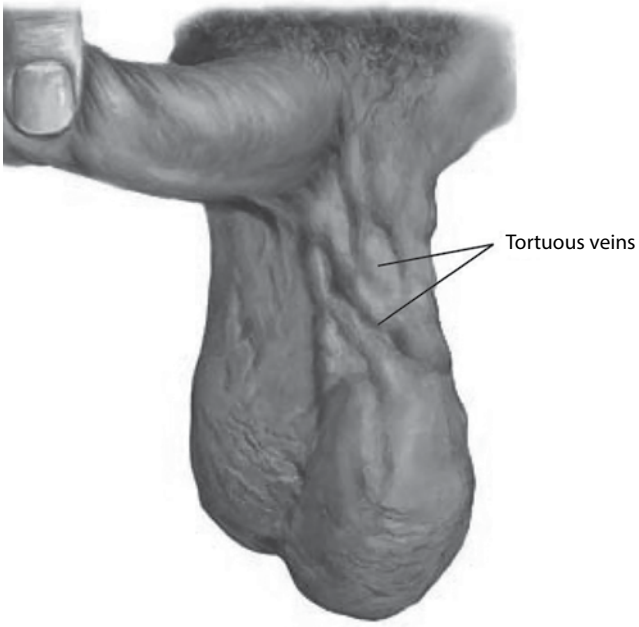


Figure 25.2 Varicocele.

History and examination

The specific details to elicit are:

- Timing of symptoms. Testicular torsion and haematoceles generally present suddenly whereas infective processes such as orchitis and epididymitis will generally worsen over the course of a day. Hydrocele, varicocele, malignancy and hernias may present insidiously over weeks or months.
- Assess the severity and nature of pain. Testicular torsion is extremely painful, whereas epididymal cysts and malignancy are generally painless.
- Is the pain worse in the evenings or when standing? This might suggest a varicocele or hydrocele.
- Has the patient experienced a dragging sensation (common with varicoceles)?
- Any blood in the urine or ejaculation? This can occur in orchitis.
- Is there a history of mumps and parotid swelling (mumps orchitis – and remember that mumps is a notifiable disease. The best way to ensure that this is correctly reported to the relevant authorities would be to contact the hospital's infection control team; alternatively, the

form is available via www.gov.uk. Details needed include date of onset of symptoms, date of diagnosis, and demographic details of the patient including work or school address).

- Ask if the patient has experienced any urinary tract symptoms which might suggest an infective cause (dysuria, increased frequency, urgency).
- History of previous sexually transmitted disease (epididymitis/orchitis).
- History of recent trauma (testicular torsion, haematocele).
- Age of patient (testicular torsion is more common in adolescents and should still be a strong consideration for men in their early 20s; testicular malignancy most commonly occurs in those aged 18–50).

As part of a full abdominal examination focus on the external genitalia. It is important you offer the patient a chaperone and document clearly if they refuse one. In many hospitals, for doctors' protection it is stated that a chaperone is mandatory for all intimate examinations.

Exposure

Consider maintaining the patient's dignity by allowing them to put the top half of their clothing back on, or a hospital gown. Comprehensive examination is most easily allowed by having them unclothed from the waist to knees.

Inspection

Perform this lying down then standing up.

- Is the testicle elevated or lying horizontally? (Testicular torsion)
- Does the swelling increase in size with the patient standing? (Hydrocele, varicocele)
- Is the swelling on the left-hand side? Varicoceles are most commonly found on left-hand side and can look like a 'bag of worms'.
- Is there urethral discharge? Is it blood stained? (Epididymitis, orchitis)

Palpation

- Is it too painful to palpate? (Testicular torsion)
- Can you get above the swelling? (Yes: Swelling of scrotal origin; no: Consider hernia)
- Is there a positive cough impulse over the hernia orifices? (Hernia; see Chapter 10 to know how to perform this test).

- Is there an absent cremasteric reflex? A cremasteric reflex means that if you gently stroke the inside of the thigh, the testis rise within the scrotum – explain this test to the patient before doing it! (Testicular torsion)
- Is the swelling fluctuant and transilluminable? If you turn the lights off and shine a pen torch through the swelling from behind, it will glow. (Hydrocele)
- Is the swelling located on the posterior pole of the testicle? (Epididymal cyst)
- What is the shape, consistency and size of the palpable mass? (Any firm or hard swelling is malignancy until proven otherwise.)

Routine investigations

Routine bloods should be ordered including:

- *FBC (full blood count) and CRP (C-reactive protein)*: WCC (white cell count), neutrophil count and CRP will give you an indication if there is an infective process.
- *Renal function*: May be deranged in an infective process that has ascended to the kidneys.
- *Clotting*: In case urgent surgery is required.
- *Urinalysis*
  - A urine dipstick can confirm the presence of infection (positive result for nitrites more suggestive of only leucocytes).
  - All patients should have a urine microscopy, culture and sensitivity sent (the presence of infection cannot be excluded with a dipstick, which has around a 30% false negative rate).
  - All patients with suspected malignancy should have a urine cytology sent and marked as urgent.

Specialist investigations following discussion with seniors

- Ultrasound scan of scrotum
  - This will elicit the nature of any swelling and allow differentiation between various fluid-filled swellings as well as solitary lesions.
  - It is also particularly useful in the context of a hydrocoele or orchitis which may masquerade as a testicular malignancy.
- Staging CT CAP (computerised tomography of chest, abdomen and pelvis).

- If testicular malignancy is diagnosed a staging CT CAP will be required to fully assess the primary malignancy and look for potential metastasis (see Chapter 26).

Specific scenarios

Where a patient presents with sudden onset testicular pain. The pain is severe and unilateral.

Testicular torsion must be ruled out here and this patient should be seen urgently.

- Quickly assess the patient and get early senior involvement. There is a 4–6 hour window to manage a testicular torsion surgically so management must not be delayed. Throughout and beyond this time period, chances of testicular salvage decline linearly.
- Give the patient adequate analgesia. Testicular torsion is extremely painful and the patient is likely to require morphine e.g. 5–10 mg oramorph or up to 5 mg IV morphine.
- Keep the patient nil-by-mouth and prepare them for theatre.
- See Chapter 32 for further details.

Where a patient has presented with acute onset urethral discharge, testicular swelling and signs of sepsis.

This patient has a genitourinary infection and has developed sepsis. The sepsis should be managed first, before further investigation into the source of the infection.

Assess the patient and resuscitate them using an ABCDE (airway, breathing, circulation, disability, exposure) approach.

- Start IV fluids and IV antibiotics (see local antibiotic guidelines; com monly used antibiotics include co-amoxiclav 1.2 g TDS, piperacillin/tazobactam 4.5 g TDS or gentamicin 5 mg/kg OD [omne in die (once daily)], in the absence of renal impairtment).
- Catheterise the patient and take bloods including a VBG (venous blood gas) for the lactate.
- Ensure a mid-stream urine sample and urethral swab are sent for microscopy, culture and sensitivity (MC&S).
- Prescribe analgesia and anti-inflammatory medication such as ibuprofen 400 mg TDS PO (per os [orally]). Use alternative analgesia if contraindication to NSAIDs (nonsteroidal anti-inflammatory drugs), such as asthma.

- If the sepsis does not settle, an inpatient scrotal ultrasound scan should be ordered to rule out a scrotal or intratesticular abscess which would warrant drainage. If the patient recovers well following antibiotics, an outpatient ultrasound will both exclude malignancy and assess for resolution of testicular swelling; this should be done within 2 weeks of presentation to ensure timely diagnosis of an underlying malignancy, if present.

Where a patient presents with a painless testicular lump, palpable on the body of the testicle.

Testicular malignancy must be ruled out urgently in this patient (see Chapter 26).

- Assess the patient's biochemical markers and urine dip to exclude an infective cause. Also send testicular tumour markers: α-fetoprotein, β-HCG (human chorionic gonadotropin) and LDH (lactate dehydrogenase).
- Order an urgent scrotal ultrasound scan to confirm the nature of the swelling and whether it is potentially malignant. It is best practice to get this done on the same day that the patient presents, but if this is not possible then this can be performed as an outpatient ($<$2 week wait).
- The patient should be reviewed by an urologist as soon as possible after the ultrasound scan so that they may be counselled regarding orchidectomy. The urologist will arrange onward referral to an oncologist for the patient to be seen with the histology results following orchidectomy, so that onward management may be decided.

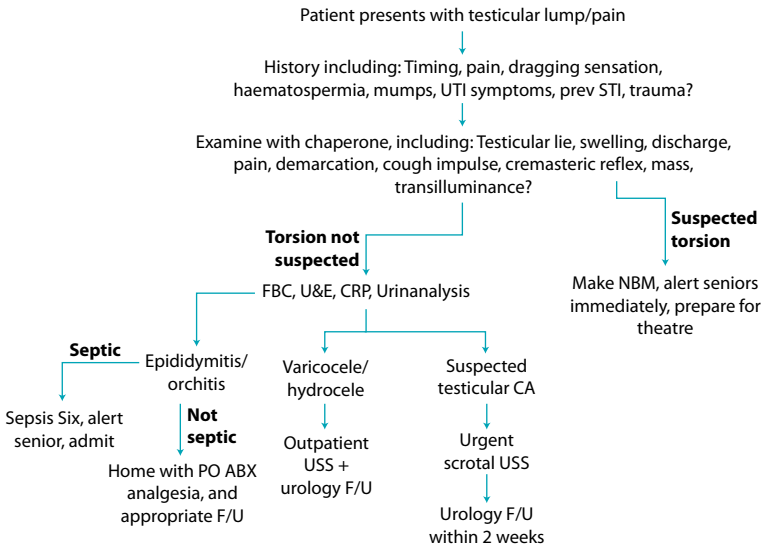
Where a patient presents with a long-standing dragging sensation in the scrotum. On examination, there is a fluctuant swelling that is not attached to body of testicle. They are otherwise well.

The patient's symptoms could be caused by a number of different pathologies. It is still important to rule out testicular torsion and malignancy in these patients, even if the symptoms are not typical of these conditions.

- When examining, if you are unable to get above the swelling, the patient may have a scrotal hernia (see Chapter 10).
- Since the patient is otherwise well, further investigations can be performed as an outpatient.
- An outpatient scrotal USS should be ordered, with routine urology outpatient follow up, depending on the results. It is reasonable to ask the patient to see their GP to arrange this investigation and follow up the results.

Hydroceles and varicoceles can be managed conservatively once sinister underlying causes have been ruled out; the patient should be advised that these are benign findings. If symptomatic with significant amounts of pain or weight of the swelling, the patient may benefit from elective surgery, for which they can be referred by their GP. If a varicocele is found, the patient should undergo renal USS as renal malignancy can present in this way.

Summary algorithm


Patient presents with testicular lump/pain
History including: Timing, pain, dragging sensation, haematospermia, mumps, UTI symptoms, prev STI, trauma?
Examine with chaperone, including: Testicular lie, swelling, discharge, pain, demarcation, cough impulse, cremasteric reflex, mass, transilluminance?
Suspected torsion
Make NBM, alert seniors immediately, prepare for theatre
Torsion not suspected
FBC, U&E, CRP, Urinanalysis
Septic
Epididymitis/ orchitis
Sepsis Six, alert senior, admit
Not septic
Home with PO ABX analgesia, and appropriate F/U
Varicocele/ hydrocele
Outpatient USS + urology F/U
Suspected testicular CA
Urgent scrotal USS
Urology F/U within 2 weeks

Key questions to ask over the phone when being referred a patient with a testicular lump which will make your time on-call easier:

1. Is the patient haemodynamically stable? If not, has the patient been cannulated and IV fluids/antibiotics started?
2. Has a urine sample been sent to the lab?
3. What are the WCC, CRP, and other blood results? (Request they be performed if not yet done.)
4. Could this be a testicular torsion requiring urgent attention?
5. Does the patient have any relevant past medical history, such as previous similar episodes?

Chapter 26
Genitourinary malignancies

Davoud Khodatars and Sarah Y. W. Tang

You may encounter patients with suspected genitourinary malignancy in both the emergency and the outpatient setting. It is important to have a low threshold for suspecting malignancy, particularly in patients with risk factors. The common genitourinary malignancies discussed in this section include:

- Renal cell carcinoma
- Bladder cancer
- Prostate cancer
- Testicular cancer

These conditions can generally be managed initially in the outpatient setting (<2 week wait [2WW]), provided the patient has no other reason to be admitted. Painless haematuria is a key symptom that should alert clinicians of the potential for genitourinary tract malignancy, especially in individuals over the age of 40.

The key points to consider in genitourinary malignancy referrals are:

- Is the patient unstable and requiring admission, or can they be investigated as an outpatient?
- To assess the patient for signs of urinary retention and/or obstructive nephropathy.
- To assess for signs of urological sepsis which may complicate malignancy.

History and examination

The specific details to elicit are:

- Does the patient have haematuria?
- Is the patient in pain? Painless haematuria is a common presentation in GU malignancy, whereas the presence of pain might suggest an

alternative diagnosis such as obstructive uropathy or urinary tract infection.

- Assess for constitutional symptoms suggesting malignancy such as unintentional weight loss or loss of appetite.
- Ask when the patient last passed urine?
- Ask about symptoms which might suggest a urinary tract infection such as dysuria or discharge.
- Has there been a change in bowel habit? Large tumours can compress the bowel.
- Does the patient have any risk factors for malignancy?
  - *Testicular malignancy*: Aged 25–35 teratomas and 35–45 in seminomas.
  - *Prostate cancer*: Aged over 50, smoker.
  - *Bladder cancer*: Smoking increases the risk for this 10-fold. Rubber or leather workers, or those with occupational exposure to benzidine or 2-naphthylamine (dye and pigment industries), are at risk of transitional cell bladder carcinoma. Schistosomiasis exposure (Africa and Asia) and long-term catheter or urinary stones can increase risk of squamous cell bladder carcinoma.
  - *Renal cell carcinoma*: Von Hippel–Lindau disease, ethnic origin (Afro-Caribbean), smokers, obesity.
- Ask about gynaecomastia which can be present in testicular cancer.
- Has the patient noticed any pain (makes malignancy less likely) or swelling of their testicles or scrotum?
- Assess for symptoms of metastases such as bone pain or shortness of breath which might indicate lung metastases.

As part of a full examination focus on:

- Determine if the patient is haemodynamically stable.
- Palpate for pelvic or loin masses.
- Assess for suprapubic or renal angle tenderness.
- Assess for a palpable bladder (a bladder scanner may aid assessment).
- Digital rectal exam to assess prostate size and character, nodules/irregularity and firmness/hardness to suggest malignancy.
- Assess colour of urine to determine the extent of active bleeding or the presence of clots.
- Scrotal and hernia orifice examination to assess for testicular lumps, hydrocele (can be secondary to testicular cancer), or the presence of a varicocele (can be secondary to renal cell carcinoma).

Routine investigations

Routine bloods should be ordered including:

- *FBC (full blood count) and CRP (C-reactive protein)*: The Hb will give you an idea of how severe the blood loss is if haematuria is present and a blood transfusion is warranted if they are symptomatic and/or have an Hb <8 g/dL. WCC (white cell count) and CRP will indicate whether there is an infective process. CRP may also be raised in the context of malignancy.
- *Renal function*: May be deranged where there is renal tract obstruction from clots or masses. It will also be required if you are asked to order a CT scan with contrast.
- *Group and save with clotting*: In case of severe blood loss requiring transfusion.
- *PSA (prostate specific antigen)*: This should be done prior to catheterisation, provided there is no evidence of infection. PSA measured after catheterisation reduces its specificity for prostate cancer.
- *Urinalysis*
  - A urine dipstick can confirm the presence of infection.
  - All patients should have a urine microscopy, culture and sensitivity sent (the presence of infection cannot be excluded with a dipstick, which has around a 30% false negative rate).
  - All patients with suspected malignancy should have a urine cytology sent.

Specialist investigations following discussion with seniors

- Ultrasound kidney, ureter, bladder (KUB) and scrotal scan
  - To assess for malignancy, and compressional mass effects. Allows for assessment of the renal tract and for the presence of hydronephrosis.
  - A post-void suprapubic bladder scan will help diagnose urinary retention if there is a residual >500 mL.
- Cystoscopy
  - Patients with haematuria (see Chapter 30) will require flexible cystoscopy to rule out malignancy. It is a key investigation to assess tumour invasion and biopsies can be taken for histological analysis.
- CT chest, abdomen and pelvis (CT CAP)
  - If malignancy is diagnosed, a CT scan will be required for tumour staging.
- NM (nuclear medicine) Bone scan
  - This may be requested to assess for skeletal metastases.

Specific scenarios

Where a 60-year-old man presents with painless haematuria. He is otherwise well.

In anyone with visible haematuria you should rule out GU malignancy. If they have a normal haemoglobin level and are otherwise well, this can be performed as an outpatient (<2WW).

- Assess the patient for haemodynamic instability. If they are unstable, resuscitate them with IV fluids and get early senior involvement.
- Check their haemoglobin level and perform a coagulation screen. If haemoglobin is low, they may require admission for a blood transfusion.
- Arrange an urgent (<2WW) CT urogram (this is preferable to US KUB in visible haematuria as it is more sensitive for stones or renal and ureteric malignancy) and flexible cystoscopy.

Where a patient presents with urinary retention and suprapubic pain.

Patients can present with urinary retention secondary to a number of different causes. It is important to relieve the retention before the patient develops complications such as renal impairment (see Chapter 31). Investigations can then be performed as to the cause of the retention.

- Confirm from the history and examination that the patient is in urinary retention. An US bladder scan can help confirm this; >500 mL is an indication for catheterisation in most cases. If the result is less than this, it is reasonable to discuss with the patient whether they wish to wait for the bladder to fill further, as they may 'break through' and be able to void. However, if there is significant pain, a catheter is indicated early unless the bladder volume is <300 mL, in which case further monitoring of bladder volume should be carried out and an alternative cause for the pain considered.
- Attempt to catheterise the patient. If there is evidence of blood clots then consider a three-way catheter with bladder irrigation. If you are unable to catheterise the patient they will require urgent senior involvement.
- Perform urine analysis for evidence of urinary tract infection.
- Request blood tests to assess renal function and to look for evidence of raised inflammatory markers (WCC, neutrophils, CRP) and infection.
- Once the patient is stabilised, further investigations such as imaging (US KUB or CT urogram, depending on whether any non-visible or visible haematuria coexists, respectively) and cystoscopy can be performed as appropriate.

Where an elderly gentleman presents with back pain with a background of prostate cancer

Prostate cancer is generally managed as an outpatient, however you may be referred patients with complications of prostate cancer in the emergency setting. It is likely that this patient has spinal metastasis which is causing back pain.

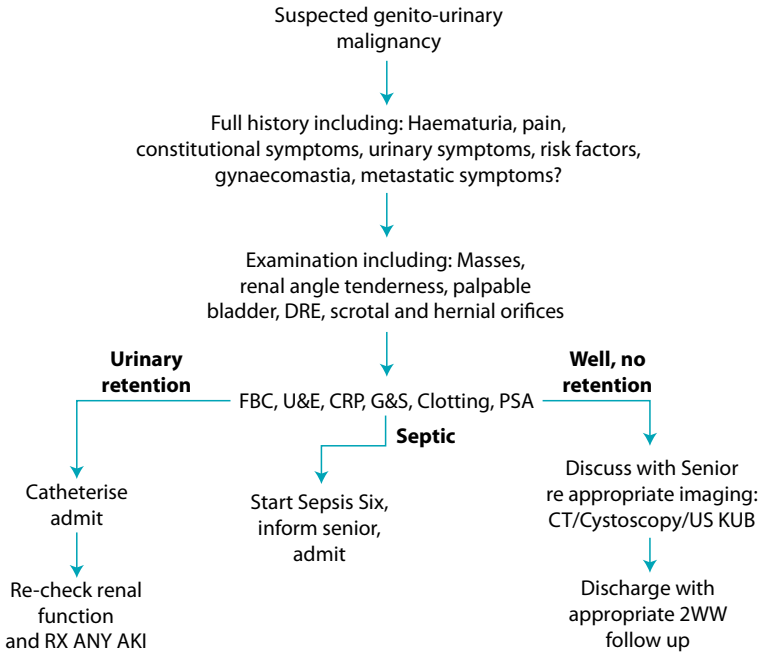
- Look for signs of cauda equina syndrome (altered sensation or progressive weakness/numbness in the lower limbs, urinary or bowel incontinence, lower back pain, or 'saddle' anaesthesia, altered or loss of sensation of the inner thighs, buttocks, back of legs or sacral region).
  - Questions to ask include: any problems with walking or altered sensation/paraesthesia in the lower limbs? Any problems with urinating or bowels? Any back pain?
  - Perform a full lower limb neurological examination including a check for saddle anaesthesia by testing the S2–4 dermatomes around the perineum, and a rectal examination to test for anal sphincter tone.
- If cauda equina syndrome is suspected, the patient will need urgent discussion with a spinal surgeon and an MRI of lumbar spine. They should be placed under 'spinal precautions' so that they remain flat in bed and do not mobilise until further assessment.
- Find out the severity of the pain. If it is severe and not responsive to simple analgesia, admission may be required and pain team review.
- If the pain is manageable with simple analgesia, and there is no evidence of spinal cord compression, the patient can be discharged and seen as a 2WW referral in urology outpatients. They will likely require further imaging as an outpatient, such as a CT CAP or NM bone scan. As a safety net and due to local protocols, it is often safest to ask the patient to see their GP the next day for a 2WW referral, and the discharge letter from the emergency review should also request this. If a recent NM bone scan has not been performed, this could be requested by the on-call doctor under Target (2WW) criteria for expeditious scheduling of the test. The results of these will likely be discussed later in an MDT (multidisciplinary team) meeting following the patient's consultation with an urologist as an outpatient.

Where a patient presents with a testicular lump, palpable on the body of the testicle.

- Assess the patient's laboratory markers (WCC, neutrophils, CRP) and urine dip (nitrites, leucocytes) to exclude an infective cause. Also send testicular tumour markers: α-fetoprotein, β-HCG (human chorionic gonadotropin) and LDH (lactate dehydrogenase).

- Order an urgent ultrasound scan to confirm the nature of the swelling and whether it is potentially malignant. It is best practice to get this done on the same day that the patient presents, but if this is not possible then this can be performed as an outpatient (<2WW).
- The patient should be reviewed by an urologist as soon as possible after the ultrasound scan so that they may be counselled regarding orchidectomy.

Summary algorithm


Suspected genito-urinary malignancy
Full history including: Haematuria, pain, constitutional symptoms, urinary symptoms, risk factors, gynaecomastia, metastatic symptoms?
Examination including: Masses, renal angle tenderness, palpable bladder, DRE, scrotal and hernial orifices
Urinary retention
FBC, U&E, CRP, G&S, Clotting, PSA
Well, no retention
Septic
Catheterise admit
Re-check renal function and RX ANY AKI
Start Sepsis Six, inform senior, admit
Discuss with Senior re appropriate imaging: CT/Cystoscopy/US KUB
Discharge with appropriate 2WW follow up

Key questions to ask over the phone when being referred a genitourinary malignancy case which will make your time on-call easier:

1. Is the patient haemodynamically stable? If not, has the patient been cannulated and IV fluids/antibiotics started?
2. Has a urine sample been sent to the lab?
3. What was the WCC and CRP and other blood results? (Request they be performed if not yet done.)
4. If in retention, has a urinary catheter been inserted?
5. Is there evidence of acute kidney injury? Does this patient need an early senior input?

Taylor & Francis
Taylor & Francis Group
http://taylorandfrancis.com

Chapter 27
Urinary calculus disease

Christopher Bastianpillai

Urinary calculi are formed by the supersaturation and precipitation of various salts and minerals in the urine. They are a common phenomenon, although a large proportion of them remain asymptomatic. They are more prevalent in men than in women, with a peak age of around 30–50 years. Stones can be classified by composition, with common types including calcium phosphate/oxalate (80%), uric acid (10%–20%), struvite (1%–5%) and cystine (1%). Stones generally become symptomatic when they pass from the renal collecting system into the ureters, causing obstruction, which results in 'renal' (ureteric!) colic. This can be further complicated by renal impairment and superimposed infection.

The key points to consider when referred patients presenting with renal colic are:

- Can the patient be managed conservatively or could they require surgical intervention?
- If required, how urgently does intervention need to take place?
- Is an alternative diagnosis possible?

History and examination

The specific details to elicit are:

- The timing and severity of pain. Renal colic typically presents with waves of severe loin to groin pain.
- Any nausea or vomiting?
- Have they noticed haematuria? If so, for how long?
- Ask about symptoms of bladder irritation, such as frequency or urgency. This can result from stones at the vesicoureteric junction.

- Features of infection such as fever, rigors, dysuria, or discharge.
- Prior history of renal stones. How were they managed?
- Is there a family history of renal stones?
- Do they have any relevant past medical history such as pre-existing renal disease or a solitary kidney?
- Do they have any symptoms which might suggest an alternative intra-abdominal pathology?

> **Tip:** Beware the patient with an abdominal aortic aneurysm who is referred as renal colic. Many urology departments will not accept such patients until the diagnosis has been proven, so check with your seniors what the policy is when you start your job.

As part of a full examination focus on:

- Assess for signs of sepsis (hypo-/hyperthermia, tachycardia, hypotension, raised inflammatory markers, raised lactate).
- Palpate the abdomen and costovertebral (renal) angles for tenderness. Abdominal examination is normally unremarkable in renal colic; tenderness anteriorly may indicate an alternate pathology.
- Feel for a palpable bladder which might indicate urinary retention.
- Always palpate for an abdominal aortic aneurysm, particularly in older patients with no prior history of renal stones.

Routine investigations

Routine bloods should be ordered including:

- *FBC (full blood count) and CRP (C-reactive protein)*: To assess for signs of infection. A mild leucocytosis may be seen as a stress response to renal colic, but a significantly raised WCC (white cell count) ($>15 \times 10^9$/L) should trigger suspicion for a superimposed infection.
- *Renal function*: To assess for renal impairment.
- *Serum calcium, phosphate, and urate*: To assess for metabolic predisposing factors.
- *Coagulation screen*: May be useful should an intervention become necessary (see later for more detail).
- *Urinalysis*
  - Microscopic haematuria is present in around 85% of renal colic cases.
  - Nitrites and leucocytes may indicate infection.

- A sample should be sent for microscopy, culture and sensitivities if infection is suspected, prior to commencing antibiotics.
- A pregnancy test can be carried out where appropriate, both to exclude ectopic pregnancy, and to ensure suitability for CT scanning (as detailed below).

Non-contrast CT of kidneys, ureters and bladder (KUB):

- This is the preferred first-line imaging for most cases of suspected renal colic, as it is highly sensitive (>99%). The only stones which are not seen on CT KUB are formed in patients taking antiretroviral medication for HIV (human immunodeficiency virus) e.g. Indinavir and others of the same family.
- Ultrasonography has a poorer sensitivity (45%) but has a role as a first-line investigation in pregnancy and in children.
- Imaging is useful to confirm the diagnosis and it should be performed without delay in patients with a solitary kidney, fever or where there is diagnostic uncertainty.

Specialist investigations following discussion with seniors

- Stone analysis:
  - Patients are asked to filter their urine to collect passed stones for analysis.
  - This is generally performed in first-time stone formers, as well as those who develop recurrent stones despite drug therapy or complete stone clearance.

Specific scenarios

Where a patient with renal colic has a stone ≤8 mm, and they have no signs of renal impairment or infection.

Once the diagnosis has been confirmed on imaging, a decision can be made on whether the stone is to be managed conservatively, or whether the patient requires admission for possible intervention, normally in the form of a ureteric stent.

Patients with uncomplicated stones that are likely to pass may be managed conservatively. There is not an exact threshold stone size that will guarantee a stone will pass spontaneously, however, it is unlikely to occur in stones >8 mm. Approximate stone passage rates depending on size are:

<5 mm	95%
5–8 mm	60%–70%

Stones <8 mm can generally be managed conservatively (although consult local guidelines and/or discuss with seniors) if the pain is under control and there is no renal impairment.

- Give effective analgesia:
  - NSAIDs (nonsteroidal anti-inflammatory drugs) are particularly effective for treating pain due to urinary calculus disease; diclofenac 50–100 mg PR (to a maximum dose of 150 mg per day) is especially good in the acute setting. Ibuprofen 400 mg TDS or naproxen 250 mg BD are good regular NSAIDs to use.
  - Advise the patient to use gastroprotective agents such as Gaviscon or Omeprazole 20 mg OD (OD [once daily]) if they will be using NSAIDs for more than 1–2 weeks.
  - Opoids are often a necessary regular analgesic e.g. codeine phosphate 30–60 mg QDS or tramadol 50–100 mg QDS.
  - These should always be prescribed with a laxative e.g. lactulose 10–15 mL BD as the side effect of constipation can be immediate and severe.
  - Consider adding anti-emetics e.g. cyclizine 50 mg TDS or ondansetron 4 mg QDS.
- Ensure they are well hydrated.
- If their pain is adequately controlled they can be discharged home with analgesia and medical expulsion therapy in the form of an α-blocker (tamsulosin 400 micrograms OD).
- Book follow-up imaging in 3–4 weeks to ensure the stone has passed. Ensure there is a plan in place for who will review and act on the result of this!
- Instruct the patient to return quickly should they develop non-remitting pain or symptoms of infection.

Stone prevention following the first episode is also important, and involves general lifestyle measures. The single most important change that patients should make is to maintain adequate fluid intake (2–3 L/day with the aim of voiding very light-coloured urine). Dietary modifications such as reducing oxalate/sodium/protein intake, and specific therapies for metabolic abnormalities, may also be of use.

Where a patient has a stone >8 mm (or smaller depending on local protocols), or has intractable pain from renal colic.

- Patients with large stones or intractable pain should be admitted and an effective analgesia regime started with anti-emetics (see details in previous section).

- Keep nil-by-mouth pending intervention, in the form of a ureteric stent, which might be required in the same admission.
  - If this is required it would usually be arranged on an emergency list or if there is an elective slot available within the next few days.

Following insertion of a stent in the acute episode, or following failed expectant management, there are several options for definitive stone removal electively. They include:

- *Extracorporeal shockwave lithotripsy (ESWL)*: A non-invasive method where an acoustic pulse is administered from outside the patient's body to fragment a stone and allow it to pass.
- *Ureteroscopy*: Where the stone is accessed endoscopically per urethra and then fragmented, or simply grasped with a basket and removed.
- *Percutaneous nephrolithotomy (PCNL)*: Percutaneous access to the kidney achieved in order to insert a nephroscope to remove or fragment the stone.
- *Laparoscopic/open surgery*: Required in rare cases where the above options have failed or in very specific scenarios e.g. for extremely large stones.

Where a patient has an obstructing stone causing renal impairment.

Patients who have developed/are at risk of developing acute kidney injury should be managed on an urgent basis.

- Admit the patient as above and administer an effective analgesia regime.
- Inform a senior urgently in the presence of a solitary kidney, bilateral obstruction or severe acute kidney injury.

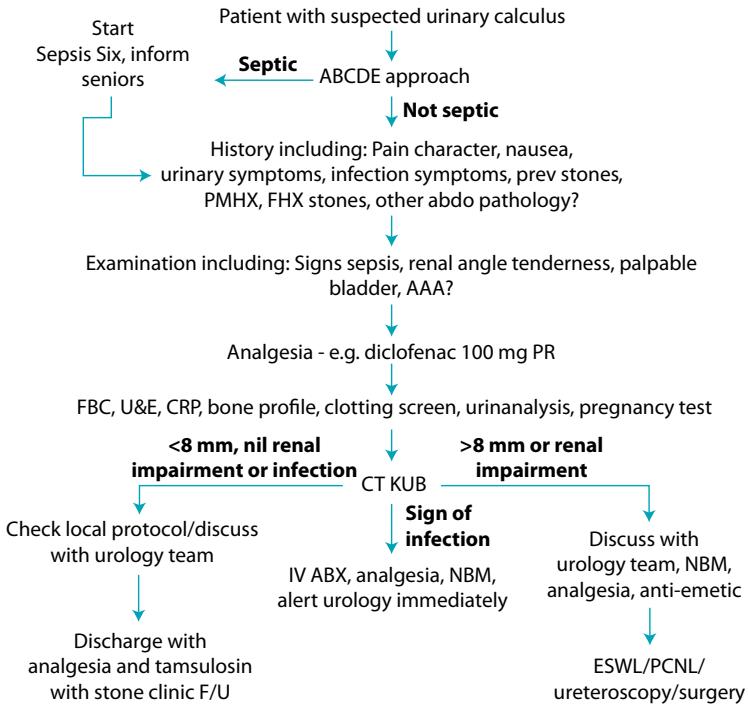
Where a patient has an obstructed infected kidney.

- Assess using an ABCDE (airway, breathing, circulation, disability, exposure) approach and resuscitate the patient with IV fluids.
- Ensure urine and blood cultures are taken.
- Administer empirical IV antibiotics in accordance with local guidelines.
- Inform a senior immediately.

These patients will require either a percutaneous nephrostomy or an indwelling ureteric stent, both are equally effective, in order to decompress the system.

Tip: An infected, obstructed kidney is an urological emergency.

Summary algorithm


Patient with suspected urinary calculus
Start Sepsis Six, inform seniors
Septic
ABCDE approach
Not septic
History including: Pain character, nausea, urinary symptoms, infection symptoms, prev stones, PMHX, FHX stones, other abdo pathology?
Examination including: Signs sepsis, renal angle tenderness, palpable bladder, AAA?
Analgesia - e.g. diclofenac 100 mg PR
FBC, U&E, CRP, bone profile, clotting screen, urinanalysis, pregnancy test
<8 mm, nil renal impairment or infection
CT KUB
>8 mm or renal impairment
Check local protocol/discuss with urology team
Sign of infection
IV ABX, analgesia, NBM, alert urology immediately
Discuss with urology team, NBM, analgesia, anti-emetic
Discharge with analgesia and tamsulosin with stone clinic F/U
ESWL/PCNL/ ureteroscopy/surgery

Key questions to ask over the phone when being referred renal colic patients, which will make your time on-call easier:

1. Has the patient been fully assessed and other, more serious causes of abdominal pain have been ruled out?
2. Does the patient have a history of urinary tract stones? Are the symptoms the same as before?
3. Are there any signs of urinary infection in the presence of an obstructing stone?
4. Have bloods been taken and renal function checked?
5. Has appropriate analgesia been given to the patient?

Chapter 28
Catheter management

Tom Bracewell, Thomas Maggs, David Manson-Bahr, and Sarah Y. W. Tang

Catheters are latex, polyurethane or silicone tubes that are passed into the bladder, usually via the urethra, to allow the drainage of urine. They can be required for many different reasons and can be used both in the acute setting and over longer periods of time, as appropriate.

Catheterising patients is not without risk, especially in the elderly who are at greater risk of catheter-associated infections with both short- and long-term catheters. The indications for catheterisation in any patient should be clearly documented and reviewed regularly, with the catheter being removed at the earliest possible time.

The key points to consider when managing patients who require catheters are:

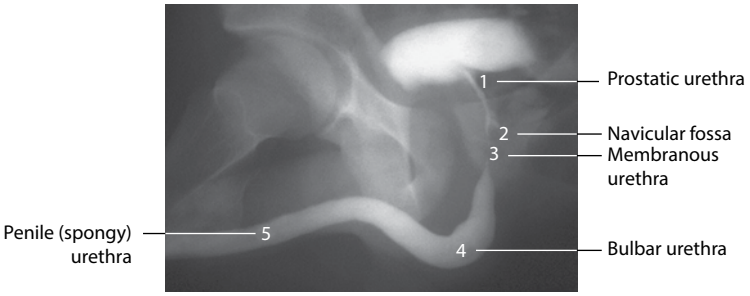
- To assess the need for a catheter or whether a convene could be used to monitor urine output or manage incontinence.
- To recognise complications associated with catheterisation.
- To recognise when catheterisation might be difficult and be aware of the various techniques that can help.

Urethral anatomy

An understanding of urethral anatomy is key to managing patients who are difficult to catheterise. In male patients, the catheter is placed through the glans penis via the external urethra. It then enters the spongy urethra (5), which forms the longest part of the urethra.

Next the bulbar urethra (4) is encountered, which becomes the membranous urethra (3). The membranous urethra is the shortest part of the urethra and is found between the bulb of urethra and apex of

the prostate. Finally the catheter enters the prostatic urethra (1), before entering into the bladder.



History and examination

The specific details to elicit are:

- When did they last pass urine? How much urine was passed?
- Any abdominal pain?
- Ask about symptoms that might suggest the patient has outlet obstruction (e.g. frequency, urgency, terminal dribbling [see Chapter 29]) as these patients may be difficult to catheterise.
- Find out what the indication for the catheter is/was and whether one is still required.
- Has the patient been experiencing bladder spasms or the urge to pass urine?

Common indications for catheterisation would be:

- Acute urinary retention
- Urinary drainage in pre-/post-operative patients
- Monitoring urine output
- Intractable incontinence
- Long-term management of bladder outflow obstruction

As part of a full examination focus on:

- Is the patient in retention?
- Are there any signs of infection?

- Check for haematuria and the presence of clots.
- Check if the catheter is blocked or bypassing

Types of catheter

Indwelling catheters can be short term (4 weeks) or long term (up to 12 weeks) and can be attached to a leg bag, night bag, or flip flow valve.

Two-way short term:

- Left for up to 14 days
- PTFE (polytetrafluoroethylene) coated latex

Two-way long term:

- Left for up to 3 months
- Silicone or hydrogel on a latex base or all silicone

Three-way:

- Generally used in haematuria/post-surgery
- Can take up to 60 mLs in the balloon

Things to note when choosing a catheter or assessing a patient with a catheter:

- Is it urethral or suprapubic?
- What is it made of (i.e. latex or silicone? Catheters are most commonly made from latex).
- The size of catheter (usually measured in Charrière [Ch]/French)

The diameter of the catheter in millimetres can be calculated using the equation:

- Diameter of catheter (mm) = Ch/3

Catheter sizes commonly used in different patient groups are:

- 6–10 Ch for paediatrics – 3 mL balloon
- 12–14 Ch for females – 10 mL balloon
- 14–16 Ch for males – 10 mL balloon
- 20–24 Ch three-way catheters for haematuria/post prostatectomy – 30 mL balloon

Contraindications to catheter insertion/ removal without senior approval

There are a number of occasions when catheterisation should be avoided or should be removed only after senior urological approval. These include:

- Patients with acute prostatitis.
- Patients with haematuria associated with pelvic trauma/fracture.

Similarly there are also times when you should not remove a catheter without first discussing the case with a senior. This includes patients who have undergone robotic radical prostatectomy within the last 10 days. In these patients the anastomosis between proximal urethra and bladder neck must be protected and a urology senior should be contacted before catheter removal. Another important example is a patient who has had a suprapubic catheter newly inserted less than 2 months prior.

Routine investigations

Depending on the reason for admission, routine bloods should be performed:

- *FBC (full blood count) and CRP (C-reactive protein)*: If the patient is bleeding, a haemoglobin level will be vital to assess severity of bleeding and guide the need for blood transfusions. WCC (white cell count) and CRP will confirm the presence of infection and help assess severity.
- *Renal function*: Is important if the patient is in retention and can be helpful in deciding whether patients can be discharged.
- Bladder scan:
  - Will help you decide if anuria is due to a blocked catheter or hypovolaemia.
  - Post-void bladder scan will help diagnose urinary retention – generally, volume should be >500 mL to be labelled as retention; less than this may be labelled as a high post-void residual volume.

> **Tip:** In gross retention some bladder scanners can be inaccurate (and may even give a recorded value of 0 mL!), so correlate with clinical findings. Similarly, patients with ascites often show large volumes on bladder scans.

- Urinalysis:
  - Can be helpful in diagnosing a urinary tract infection; however, in catheterised patients you would expect blood, leucocytes and

occasionally nitrites even when infection is not present. You should only consider treating an infection if they are symptomatic or having a procedure/operation.

Tip: Urinalysis can be falsely negative for nitrites in very dilute urine or with organisms that do not produce nitrite such as enterococci, staphylococci, acinetobacter, and adenovirus.

Procedure

Female catheterisation:

1. Explain the procedure to the patient and gain informed consent.
2. Prepare a trolley of the equipment required and place the trolley on the side of your dominant hand.
3. Ensure there is a good light source and the patient's bed is at an appropriate height.
4. Whilst maintaining the patient's dignity, expose the genitalia and place a disposable pad under the patient.
5. Wash hands before opening the pre-prepared equipment onto your trolley, within a sterile field.
6. Remove the catheter from its external wrapper, ensuring it stays in its internal wrapper, and place it into a sterile receiver in your sterile field.
7. Open and arrange the catheter bag beside the bed, ensuring the tip remains sterile.
8. Pour an appropriate amount of cleaning fluid into the gallipot.
9. Draw up the amount of sterile water required to inflate the balloon of the catheter you have chosen (many packs will contain pre-filled syringes).
10. Wash hands again and put on two pairs of sterile gloves.
11. Place sterile towel on the patient's thighs and between their legs.
12. Take a gauze swab with your non-dominant hand and retract the labia minora to expose the urethral meatus. Your non-dominant hand should now remain in this position until the end of the procedure.
13. Clean the perineal area, using a gauze swab to stroke from front to anus.
14. Place the receiver with the catheter between the patients legs, onto the sterile towel.

15. Expose the tip of the catheter by removing the end of the plastic wrapper.
16. Lubricate the catheter tip with lubricating gel.
17. Take the catheter at the proximal end, ensuring the distal end of the catheter remains in the receiver.
18. Insert the catheter tip into the urethral meatus, in an upward and backward direction, until urine flows.
19. Then advance another 5 cm. Do not force the catheter if there is resistance.
20. Inflate the balloon with the correct amount of sterile water whilst ensuring the patient is not experiencing pain.
21. Attach the catheter drainage bag in a position that ensures there is no tension on the catheter.
22. Remove the sterile field.

For male catheterisation follow the procedure up to and including point 11, then:

12. Take a gauze swab with the non-dominant hand and retract the foreskin to expose the urethral meatus.
13. Clean the penis using a gauze swab, stroking away from the urethral meatus and using a new swab for each stroke.
14. Hold the penis between 60° and 90° from the body.
15. Warn the patient that the lubricating gel may sting before injecting it into the urethra.
16. Lightly squeeze the glans of the penis to ensure the lubricating gel stays in the urethra and wait for 5 minutes to allow the gel to work.
17. Place the receiver with the catheter between the patient's legs onto the sterile towel.
18. Expose the tip of the catheter by removing the end of the plastic wrapper.
19. Lubricate the catheter tip with lubricating gel.
20. Take the catheter at the proximal end, ensuring that the distal end of the catheter remains in the receiver.
21. Insert the catheter tip into the urethral meatus, keeping the penis held vertically.
22. After approximately 10 cm, the tip of the catheter will reach the prostatic urethra, at which point angle the penis is in line with the patient's legs, while keeping it straight. This will help the catheter

to pass the prostatic urethra. Do not force the catheter if resistance is encountered.

23. Inflate the balloon with the correct amount of sterile water, ensure the patient is not in pain.
24. Attach the catheter drainage bag in a position that ensures there is no tension on the catheter.
25. Remove the sterile field.

Key points to document:

- Patient consent and the name of a chaperone
- The residual volume
- The amount of water the balloon was inflated with

Tip: The balloon is inflated with sterile water, not normal saline, as saline can crystallise over time, making it difficult to deflate the balloon

Tips and tricks for managing catheters

- For 'difficult' catheterisations, always use more anaesthetic jelly (2–3 tubes) to tent the urethra up as much as possible.
- Hold the external meatus closed to facilitate the passage of anaesthetic jelly through the urethra and to avoid it overflowing externally and making the procedure more challenging.
- When the catheter reaches the prostate, asking the patient to cough whilst maintaining gentle pressure can allow the catheter to advance past the prostate.
- If a catheter does not come out, first check how much water was put in the balloon (remember a two-way catheter can take up to 30 mL and a three-way up to 60 mL).
- If a balloon does not deflate, leave a syringe on for 30–60 minutes to see if it drains any more off. If still stuck at this point and unable to remove with a gentle pull, call the urology team for advice.
- If washout is difficult to perform, try manoeuvering the catheter around (e.g. inserting up to the hilt, deflating the balloon).
- If a catheter is not draining a bladder washout can be performed. Gently instil 20–50 mL of sterile water/normal saline into the bladder using a bladder syringe and see if it can then be withdrawn. This can help to get rid of clots/debris within the bladder.

- If encountering difficulty during bladder washout, deflating the balloon and keeping the catheter in situ can allow for better flow and therefore irrigation of debris/clots within the bladder.

Specific scenarios

You are called regarding a catheter which is bypassing (urine flowing out of the meatus around the catheter rather than through it, or the majority of the urine not flowing through the lumen of the catheter even if there is some drainage)

- Ask about the patient's level of discomfort as this will help you to prioritise how urgently you need to attend to the patient.
- Ask the nurse to flush the catheter.
- When you see the patient, assess whether the catheter looks correctly placed (if there is a longer length of catheter external to the meatus than normal, it may have been pulled distally).
- Using a clean technique as if you were inserting a catheter, deflate the catheter balloon, push the catheter in to the hilt before reinflating.
- If there is a lot of debris or clot in the catheter bag then it is likely the catheter is blocked and requires changing. Bladder washouts may also be trialled.
- Consider whether a large-sized catheter should be used or exchange like for like. Silicone catheters have a larger internal lumen for drainage so are ideal for patients who produce debris causing their catheters to block.

You are asked to catheterise a male patient where the meatus is not easily visible.

There are many reasons this could be the case:

- *The patient has a tight foreskin.* Use both hands with non-sterile gloves to work the foreskin back as fully as possible to expose the meatus. Retracting it fully behind the corona of the glans penis will help it to stay there so as not to interfere with the catheterisation process. Always remember to replace the foreskin to prevent a paraphimosis from forming! Catheterisation is the most common cause of paraphimosis and is largely avoidable.
- *The patient has a phimosis which will not fully retract.* Clean as well as possible, dripping the saline into the opening of the foreskin. Use the tip of the catheter to feel for the meatus. It will generally find its way in!

- *The patient has a phimosis which completely occludes the meatus e.g. balanitis xerotica obliterans.* If there is a tiny opening, this can be stretched up with a surgical artery clip under local anaesthetic; senior review would be required here. In severe situations, circumcision may be required prior to urethral catheterisation, in which case a suprapubic catheter may be required as a temporising measure depending on the urgency of catheterisation.
- *The patient is oedematous.* Pushing circumferentially around the base of the penis will help to make it more prominent. It is key to squeeze the oedema out of the foreskin and catheterise as soon as the meatus becomes visible following this manoeuvre.
- *The patient has a hypospadias (where the urethral meatus opens on the ventral surface of the penis).* Though this can look intimidating, there is no contraindication to catheterisation in the usual fashion. Many patients with long-term catheters may unfortunately have a traumatic hypospadias leading to an enlarged meatal opening; again, this may be catheterised in the same fashion.

You are asked to catheterise a female patient where the meatus is not easily visible.

There are many reasons this could be the case:

- *The patient is obese and it is difficult to reveal the meatus.* Ensure at least one assistant is available. They can retract fat in order to improve your access. The lateral position may help, again requiring an assistant to help the patient hold their leg up.
- *The patient appears to have normal genitalia but no obvious urethra.* As an anatomical variant, the urethra can open at the anterior vaginal wall. Inserting a finger into the vagina (explain what you are going to do, to the patient!) and running the catheter over it anteriorly can help.
- *The patient has atrophic vaginitis leading to any degree of fusion of the labia majora.* Use plenty of Instillagel as the genitalia are often red and raw which can be very painful. Insert the tip of the catheter into the introitus as anteriorly as possible and guide it by feel. As above, the catheter tip can be guided in using a finger in the vagina.
- *The patient has been subjected to female genital mutilation leading to any degree of fusion of the labia majora or minora (depending on what has not been cut away).* As above, but this is likely to be even more difficult. Depending on local policy, the hospital safeguarding team should be informed; details of this should be available on the hospital Intranet.

Suprapubic catheters

Suprapubic catheters are inserted directly into the bladder, two finger widths above the pubic symphysis. They can be used to treat both acute and chronic urine retention where urethral catheterisation is inappropriate. The type of catheter used is generally the same as those used in urethral catheterisation.

Indications for a suprapubic catheter include:

- Long-term catheter use in wheelchair user
- Patients with an active sex life
- Acute prostatitis
- Urethral stricture or other abnormal urethral anatomy
- Pelvic trauma
- Where there are complications of long-term urethral catheterisation
- When long-term catheterisation is being used to manage incontinence
- Patients who are faecally incontinent and constantly soiling a urethral catheter
- In the acute setting, where urethral catheterisation has not been possible and other options are not available

The first change of a suprapubic catheter (when the tract has not yet epithelialised) is normally performed by the urology team to ensure the tract does not close up. Changes of suprapubic catheter are avoided wherever possible within the first 10 weeks following insertion with a new tract. If the suprapubic catheter has been in for a while and the tract has epithelialised, any junior doctor/nurse should be able to change it following the same procedure as a urethral catheter: removal of the old catheter and expeditious reinsertion of a new catheter into the hole that is revealed.

> Note:
>
> If continuous irrigation is required for patients with a suprapubic catheter already in situ, normal procedure would be to insert a three-way urethral catheter for the irrigation and to spigot the suprapubic catheter (i.e. insert a bung into the drainage port of the suprapubic catheter) unless there was a contraindication to urethral catheterisation.

Specific situations

Where a patient is in urinary retention due to haematuria and large clots.

- The patient will require irrigation so catheterise with >20 Ch three-way catheter.
- A double fluid giving set is used to ensure that irrigation does not need to be stopped when changing fluid bags. Usually 3 L bags of normal saline are used. These are run via the third port on the catheter, allowing continuous flow of saline into the bladder while urine and blood flow out of the main drainage port. This causes bleeding to settle down.

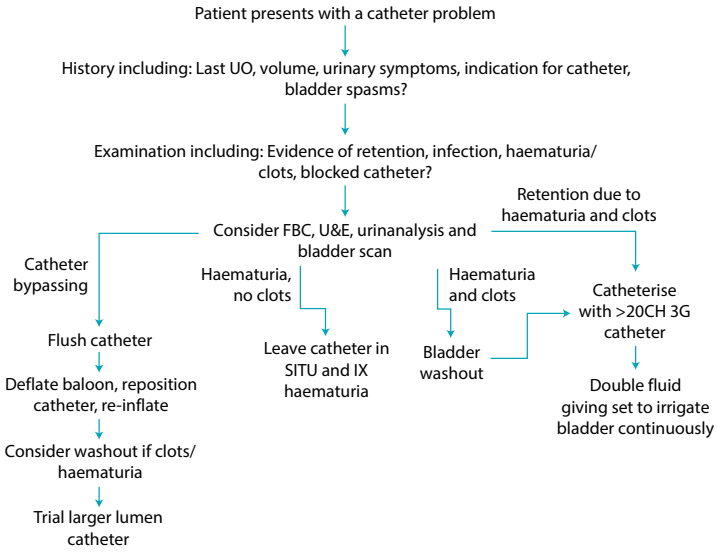
When asked to review a patient with a two-way catheter with frank red blood in it.

- If there are no clots, leave the catheter in situ at first. Investigate the haematuria as appropriate (see Chapter 30).
- If clots form and block the catheter, consider a bladder washout keeping the same catheter in situ. If the catheter has recurrent blockages despite washouts and the haematuria is not settling, change to a three-way catheter and start bladder irrigation as described above.

If asked to review a patient whose suprapubic catheter has 'fallen out'.

- Attempt to re-insert a catheter of the same size.
- If they have recently had it inserted, make sure a catheter is replaced as soon as possible.

Summary algorithm


Patient presents with a catheter problem
History including: Last UO, volume, urinary symptoms, indication for catheter, bladder spasms?
Examination including: Evidence of retention, infection, haematuria/ clots, blocked catheter?
Consider FBC, U&E, urinanalysis and bladder scan
Retention due to haematuria and clots
Catheter bypassing
Haematuria, no clots
Haematuria and clots
Catheterise with >20CH 3G catheter
Flush catheter
Deflate baloon, reposition catheter, re-inflate
Consider washout if clots/ haematuria
Trial larger lumen catheter
Leave catheter in SITU and IX haematuria
Bladder washout
Double fluid giving set to irrigate bladder continuously

Taylor & Francis
Taylor & Francis Group
http://taylorandfrancis.com

Chapter 29
Benign prostatic hyperplasia

Sarah Y. W. Tang

Benign prostatic hyperplasia (BPH) is the newer, histologically accurate term for what was formerly known as benign prostatic hypertrophy. The enlargement of the prostate gland is caused by an increase in the number of cells, not their size. It may also be referred to as benign prostatic enlargement (BPE). The symptoms seen in BPH occur when it causes bladder outflow obstruction. BPH is asymptomatic when hyperplasia has not resulted in obstruction.

BPH is a common diagnosis in men who have lower urinary tract symptoms (see Section 'History and examination'). The prevalence of BPH is 50% in men over 50 years old, increasing by 10% with each further decade of life. It is often very well managed in primary care with medication such as tamsulosin 400 micrograms OD (once daily) or finasteride 5 mg OD, but can result in presentation to the emergency department for the following reasons:

- Acute urinary retention
- Chronic urinary retention
- Haematuria

An enlarged prostate can also make urethral catheterisation difficult and you may be asked to see a BPH patient admitted for non-urological problems where the admitting team have not been able to catheterise. See Chapter 28 for more information on this.

The key points to consider when assessing patients with BPH are:

- To assess for signs of urinary retention
- To rule out malignancy

History and examination

The obstructive symptoms seen in BPH that you should ask about include:

- Frequency, urgency and nocturia:
  - These can be severe and are often the most bothersome of the symptoms.
  - Urge incontinence can be a feature.
  - These are also symptoms associated with bladder over activity.
- Hesitancy (with or without straining to void).
- Poor stream and prolonged void time:
  - The patient may note that they only void small amounts each time.
- Sensation of incomplete bladder emptying.

Other specific features to elicit are:

- Duration of symptoms:
  - Onset of symptoms over a few days (whether a completely acute presentation, or worsening of pre-existing symptoms) suggests urinary tract infection rather than true BPH.
  - A rapid onset over a few weeks raises concern of prostate cancer.
- Whether the symptoms are associated with visible haematuria:
  - This needs to be fully investigated as appropriate (see Chapter 30).
- If the patient has presented with an exacerbation of pre-existing symptoms, establish how troublesome the pre-existing symptoms were on ADLs (activities of daily living) and sleep.

As part of a full examination, specific areas to assess are:

- Is the bladder palpable?
  - A suprapubic mass is almost certainly a bladder.
  - Percuss for dullness.
  - Perform a bladder scan to confirm the volume of the bladder; under 200 mL post-void residual volumes are generally not considered clinically significant, while over 400 mL residual volumes are likely to warrant treatment.
- Digital rectal examination (DRE)
  - Assess the prostate for estimated volume and benign/malignant features.
  - Check anal tone and sensation in the saddle area.

Routine investigations

There are no specific investigations for BPH itself in the emergency setting apart from checking a post-void residual volume.

If the patient presents with complications of BPH such as retention or haematuria, the appropriate bloods and imaging are covered in chapters 30 and 31.

Specialist investigations following discussion with seniors

These are generally performed in the outpatient setting.

- PSA (prostate-specific antigen) measurement
  - In BPH, the PSA may be raised above the normal range even when adjusted for age. A key factor here is PSA density, which is calculated using prostate volume (estimated during DRE) and is generally considered to be acceptable if below 0.15.

$$\text{PSA density} = \frac{\text{PSA}}{\text{Prostate volume in cm}^3\text{(or mL)}}$$

However, if there are concerns regarding an elevated PSA in BPH, early investigation should be performed to rule out prostate cancer, especially in men with a life expectancy of greater than 10–15 years (see Chapter 26).

PSA may be falsely elevated in any setting involving:

- Acute or chronic urinary retention
- Post-catheterisation or instrumentation
- Urinary tract infection including urosepsis and prostatitis

Any of these situations could spuriously raise an otherwise normal PSA to the range of 30–40 (or 4 times any previously known baseline value). If this is found, recheck is recommended at around 1 week (where the trend should already be downwards) and then 6 weeks to establish a true baseline.

DRE is often thought to raise PSA, however, studies have shown that this is only by an average of 0.13. There is therefore no need to ensure that a PSA is taken before DRE.

Given the above limitations of PSA measurement, any raised PSA measurements could be due to either BPH or malignancy, large prostate glands with low PSA density could still harbour cancers, and small glands with low PSAs could still be malignant. Therefore clinical correlation with history and examination is of utmost importance.

Specific scenarios

A 62-year-old man presents with a 6-month history of urgency, frequency and terminal dribbling. He has a smooth enlarged prostate on DRE and a normal PSA. He is otherwise well.

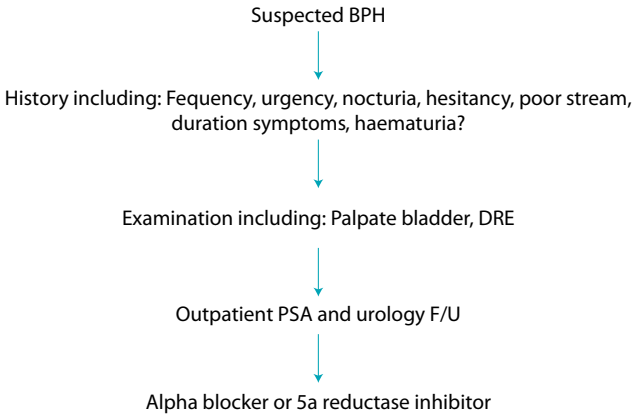
Once a diagnosis of BPH has been confirmed a number of treatment options exist.

- Tamsulosin (400 μg PO OD) is a selective α1 receptor antagonist which causes relaxation of smooth muscles, resulting in less resistance to urinary flow.
- Finasteride (5 mg PO OD) is a 5α-reductase inhibitor which acts by inhibiting the conversion of testosterone to dihydrotestosterone (dihydrotestosterone binding to its receptors on the prostate causes prostate enlargement).
- If symptoms cannot be controlled medically, transurethral resection of prostate (TURP) can be considered.
- If all else fails, a long-term urethral or suprapubic catheter may be required.

Natural sequelae

Without control of bladder outlet obstruction, BPH is likely to progress to chronic urinary retention. If this decompensates into a high-pressure system it can give rise to the 'unsafe bladder' seen in obstructive uropathy and result in chronic kidney disease (CKD). The treatment of BPH is therefore important not just for symptom relief, but also for long-term preservation of renal function.

Summary algorithm


Suspected BPH
History including: Fequency, urgency, nocturia, hesitancy, poor stream, duration symptoms, haematuria?
Examination including: Palpate bladder, DRE
Outpatient PSA and urology F/U
Alpha blocker or 5a reductase inhibitor

Key questions to ask when being referred a BPH case:

1. How long have the symptoms been going on? How have they changed to prompt this referral? How is it affecting the patient?
2. What medication is the patient taking and for how long? Have they helped?
3. When and what was the documented post-void residual volume?
4. Is the patient fit for surgery? Co-morbidities?
5. Have blood tests, including PSA and renal function, been performed?
6. Has a DRE been performed?
7. Any haematuria?

Taylor & Francis
Taylor & Francis Group
http://taylorandfrancis.com

Chapter 30
Haematuria

Christopher Bastianpillai

Haematuria is the presence of blood in the urine. It can be categorised into visible (macroscopic) haematuria and non-visible (microscopic). Visible haematuria can result from as little as 1 mL of blood in 1 L of urine. It is a commonly encountered presenting complaint in the emergency setting and can originate from any point along the urinary tract. Common urological causes include:

- Urological malignancy
- Benign prostatic hyperplasia
- Urinary tract infection
- Urinary calculi
- Recent urological surgery/instrumentation
- Trauma (e.g. from indwelling catheter)

It is important to also consider medical causes (glomerulonephritis, coagulopathies), gynaecological causes (endometriosis), idiopathic causes (exercise-induced haematuria), and drug-induced causes. Finally, patients may present with a pseudohaematuria, where the urine has been discoloured due to ingestion of certain foods or medication, mimicking haematuria. Careful history and examination will guide you in determining which of these is most likely.

In patients presenting with visible haematuria without any other significant symptoms:

The key points to consider are:

- The source of the bleeding.
- The extent of blood loss and whether it is significant enough to require admission.
- The presence of blood clots which may lead to urinary retention.

History and examination

The specific details to elicit are:

- Duration and quantity of haematuria.
- Timing of haematuria. Bleeding solely at the onset or end of micturition suggests a source in the prostate, urethra, or bladder neck. Bleeding throughout micturition suggests bladder or upper tract disorder.
- Whether it is painful (renal colic, infection, acute obstruction) or painless (possible malignancy).
- Presence of clots and symptoms of urinary retention or impending urinary retention: Acute onset of frequency, urgency, straining to void, poor urinary stream, voiding small amounts, sensation of incomplete bladder emptying.
- Presence and severity of infective symptoms: Dysuria, frequency, and urgency.
- Symptoms of chronic bladder outflow obstruction (poor stream, terminal dribbling, hesitancy) which may indicate benign/malignant prostatic enlargement or bladder malignancy.
- Symptoms of bladder irritation (frequency, urgency) which may indicate inflammation or malignancy.
- Has the patient undergone any recent trauma or surgery such as catheter insertion or injury to loins, pelvis or perineum?
- Constitutional/metastatic symptoms (e.g. weight loss, back pain) which may signify underlying malignancy.
- Does the patient have any risk factors for malignancy such as:
  - Smoking history (2–6 × increased risk of bladder cancer)
  - Occupational exposure (rubber/dye industry)
  - Previous pelvic radiotherapy
  - Long-term catheter use (16–20× increased risk of squamous cell carcinoma)
  - Exposure to schistosomiasis (Middle Eastern countries e.g. Egypt) increases the risk of squamous cell carcinoma.
- Is the patient on chemotherapeutic agents that can cause cystitis (e.g. ciclosporin)?
- Is the patient taking antiplatelets or anticoagulants?

Tip: Anticoagulants may exacerbate bleeding from another underlying cause, but should NOT be attributed as the sole cause for haematuria until other sources have been ruled out.

As part of a full examination focus on:

- Determining if the patient is haemodynamically stable.
- Palpating for pelvic or loin masses.
- Assessing for suprapubic or renal angle tenderness.
- Assessing for a palpable bladder (a bladder scanner may aid assessment).
- Digital rectal exam to assess prostate size and character.
- Assess colour of urine to determine the extent of active bleeding or the presence of clots.

Routine investigations

Routine bloods should be ordered including:

- *FBC (full blood count) and CRP (C-reactive protein)*: The Hb will give you an idea of how severe the blood loss is. WCC (white cell count) and CRP will give an indication of whether an infection is present and how severe it is.
- *Renal function*: May be deranged where there is obstruction from clots, stones, or masses. It will also be required if you are asked to order a CT scan with contrast.
- *Group and save with clotting*: In case of severe blood loss requiring transfusion.
- *PSA (prostate-specific antigen)*: This should be done prior to catheterisation (which can raise PSA by up to 20), and provided there is no evidence of infection. PSA measurement after these procedures may be erroneously high.
- *Urinalysis*
  - A urine dipstick can confirm the presence of infection, or may show significant proteinuria if a kidney disease (e.g. glomerulonephritis) is present.
  - All patients should have a urine microscopy, culture and sensitivity sent (the presence of infection cannot be excluded with a dipstick, which has around a 30% false negative rate).
  - All patients with suspected malignancy should have a urine cytology sent.
- *CT kidneys, ureters and bladder (KUB)*
  - A CT KUB can be conducted in the emergency setting if renal colic is suspected

Specialist investigations following discussion with seniors

All patients with unexplained visible haematuria require further investigation. Around 20% of patients with visible haematuria are found to have a urinary tract malignancy. If the patient is unstable and admitted, these can be performed as an inpatient. In otherwise well patients, they should be conducted as outpatients on a target 2-week wait basis.

- *Ultrasound KUB*
  - This can be used to image the renal parenchyma and detect large bladder lesions, provided the bladder is full at the time of assessment. However, it may not detect ureteric lesions.
- *CT intravenous urogram (IVU)*
  - This is a multi-phase scan that is able to show enhancing lesions during the arterial phase and filling defects during the excretory phase. It is therefore better at detecting ureteric lesions than US KUB. This makes it the optimum choice for upper tract imaging if there is a strong suspicion of malignancy. Note that a separate, triple-phase renal CT is often required if a renal malignancy is seen at CT urogram.
- *Flexible cystoscopy*
  - This can be used to assess the bladder urothelium, and is done as a day case under local anaesthetic. It carries a 1% risk of sepsis and a small risk of precipitating urinary retention.
  - If a lesion is identified, rigid cystoscopy or transurethral resection of bladder tumour (TURBT) under general anaesthetic may be required for biopsy, to provide a tissue diagnosis and further information on grading and staging (a CT chest/abdo/pelvis would complete initial staging investigations).

Specific scenarios

Where a patient has presented with light red visible haematuria, with no sign of clots, and no sign of haemodynamic instability.

- Ensure a urine dipstick is performed and sent for culture. Start antibiotics (refer to local antibiotic guidelines but some commonly used oral antibiotics are: Trimethoprim 200 mg BD, nitrofurantoin 50 mg QDS [avoid in renal impairment], co-amoxiclav 625 mg TDS or ciprofloxacin 500 mg BD) if an infection is present.

- The patient can be discharged home, provided there are no other concerns.
- Ensure that they are followed up by their GP (general practitioner). If no infection is present, they must be referred to urologist as an outpatient (unless a nephrological cause is suspected). NICE (National Institute for Health and Care Excellence) guidance states this should be done via a suspected cancer pathway if they are 45 years or older. If an infection is present, this should be treated first and referred as above if haematuria persists after the infection has resolved. Note that despite the guidelines, many urologists would advocate investigation of visible haematuria even following an infection, due to the high risk of malignancy compared to the relatively low risk of the investigations performed.

Where a patient has presented with visible haematuria and is haemodynamically unstable, or has had a significant drop in haemoglobin.

- Assess the patient and perform initial measures to resuscitate the patient. This may include the need for blood transfusion.
- Insert a 3-way catheter.
- Ensure early senior involvement and consider keeping the patient nil-by-mouth, should the patient require surgery.

In the case of painless visible haematuria, two main situations require hospital admission:

- Patients who are haemodynamically unstable, or have signs of significant ongoing blood loss or anaemia, should be admitted and appropriately resuscitated. A senior should be contacted immediately if there is significant uncontrolled blood loss.
- Patients who have developed clot retention, or who are passing large clots and are at risk of retention occurring. These patients should be catheterised with a 3-way Foley catheter and commenced on bladder irrigation. Patients who are not at risk of developing clot retention do not routinely require catheterisation.

If the patient has not developed these complications and there are no other issues that require hospital admission, they can be safely discharged home with arrangements made for the appropriate target outpatient investigations.

Patients taking antiplatelet or anticoagulant medication may require these to be held or even reversed, once the risks and benefits have been

carefully weighed. Advice may need to be sought from the haematology SpR (specialist registrar) on-call and seniors.

Bleeding will usually settle on irrigation, but manual bladder washouts with normal saline and a bladder syringe may be needed to ensure extrusion of larger clots. If the haematuria does not settle with conservative management, further intervention in the form of cystoscopy, washout, and transurethral resection of prostate (TURP or TURBT) may be required. Interventional radiology for angio-embolisation, or even open surgical resection, may rarely be required. However, these decisions would be made at a senior level after careful consideration.

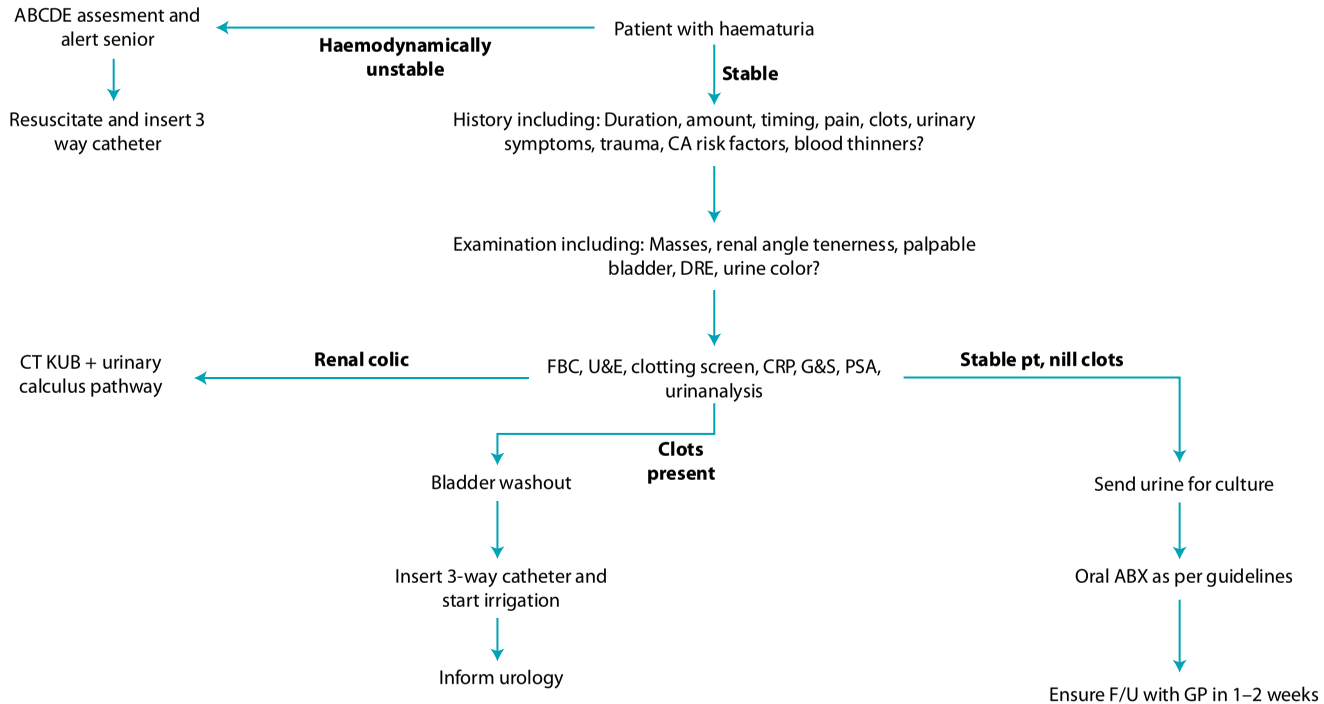
Where a patient has presented with visible haematuria with clots ± urinary retention.

- Ensure a 3-way Foley catheter has been inserted and that they are started on bladder irrigation. Prior to commencing irrigation, performing a manual bladder washout with a bladder syringe can be useful to ensure larger clots are extruded. Always ensure a urine sample has been collected to send to lab before irrigation is started.
- Patients with ongoing deep red haematuria without clots may also be considered for irrigation if it is felt that they are at risk of developing clots. This can be weighed up and discussed with the patient.
- Initial investigations as above should be conducted, and further investigations for haematuria may be arranged as an inpatient or following discharge.

Summary algorithm

Key questions to ask over the phone when being referred a haematuria case which will make your time on-call easier:

1. Is the patient haemodynamically stable? If not, has the patient been cannulated and IV fluids/antibiotics started?
2. Has a urine sample been sent to the lab?
3. What were the Hb and other blood results? (Request they be performed if not yet done.)
4. Is the patient exhibiting signs of sepsis?
5. If necessary, has the patient been catheterised?


Patient with haematuria
Haemodynamically unstable
ABCDE assesment and alert senior
Resuscitate and insert 3 way catheter
Stable
History including: Duration, amount, timing, pain, clots, urinary symptoms, trauma, CA risk factors, blood thinners?
Examination including: Masses, renal angle tenerness, palpable bladder, DRE, urine color?
FBC, U&E, clotting screen, CRP, G&S, PSA, urinanalysis
Renal colic
CT KUB + urinary calculus pathway
Clots present
Bladder washout
Insert 3-way catheter and start irrigation
Inform urology
Stable pt, nill clots
Send urine for culture
Oral ABX as per guidelines
Ensure F/U with GP in 1–2 weeks

Taylor & Francis
Taylor & Francis Group
http://taylorandfrancis.com

Chapter 31
Urinary retention

Christopher Bastianpillai

Urinary retention is a broad term, which can either describe an acute inability to pass urine or a chronic inability to fully empty the bladder. Acute and chronic urinary retention differ in presentation and management, so it is important to make this distinction when seeing patients on-call.

Acute urinary retention describes a sudden inability to pass urine. It is normally painful but can occasionally be painless if due to a neurological cause. Chronic urinary retention may be asymptomatic or may manifest with insidiously worsening symptoms of bladder outflow obstruction, leading to a large distended bladder, which is often painless. Patients may alternatively present in acute-on-chronic urinary retention.

Chronic urinary retention can then be further subdivided into high and low pressure, referring to the detrusor pressure at the end of micturition. High-pressure chronic retention (HPCR) results in a transmitted high pressure in the upper urinary tract, resulting in bilateral hydronephrosis and renal impairment. Low-pressure chronic retention (LPCR) occurs in patients with a very compliant bladder, where there may be very high volume retention but no hydronephrosis or renal impairment. The causes of urinary retention can be classified as follows:

Inflammatory/infectious:

- Balanitis
- Prostatitis/prostatic abscess
- Vulvovaginits
- Cystitis
- Herpes simplex virus (HSV) infection
- Lower urinary tract infection

Obstructive:

- Meatal stenosis
- Phimosis
- Urethral stricture
- Benign prostatic hyperplasia
- Pelvic mass (benign/malignant)
- *Rectal/uterine prolapse* – where descent of pelvic organs or tracts drags the bladder wall down with it
- Faecal impaction

Pharmacological:

- Anticholinergics (e.g. oxybutynin, tolterodine, fexofenadine)
- Muscle relaxants (e.g. baclofen)
- Antidepressant medication (amitriptyline, tricyclic antidepressants)
- Opioids
- Spinal anaesthesia

Neurological:

- Autonomic/peripheral nerve (e.g. diabetes mellitus, multiple sclerosis, Guillain–Barre)
- Brain (e.g. Parkinson's disease)
- Spinal cord (e.g. Cauda Equina)

History and examination

The specific details to elicit are:

- Duration of symptoms
- Is the retention painful or painless?
- History of lower urinary tract symptoms (LUTS) to indicate chronic outflow obstruction (frequency, urgency, nocturia, hesitancy, strangury, post-micturition dribbling) or prior episodes of retention
- Symptoms of urinary tract infection
- Constipation

- Spinal trauma/back pain/neurological symptoms
- Features of malignancy (e.g. weight loss)
- Previous urological surgery

As part of a full examination focus on:

- Is there a palpable bladder? This is often tender in acute retention but may not be tender in chronic retention
- Presence of pelvic masses
- Digital rectal examination to assess anal tone and sensation, presence of faecal impaction, and size, character and tenderness of the prostate
- Examination of external genitalia for the presence of phimosis or meatal stenosis, or vulva/vaginal inflammation
- Lower limb neurological examination if a neurogenic cause is suspected

Routine investigations

Routine bloods should be ordered including:

- *FBC (full blood count) and CRP (C-reactive protein)*: To assess for signs of infection
- *Renal function*: Renal impairment is a common complication of urinary retention and its severity will guide management
- *Urinalysis*
  - This will help confirm the presence of infection
  - Urine should be sent for microscopy, culture and sensitivity. This may indicate the presence of infection not identified on dipstick and will help guide further antibiotic therapy
- *Bladder scan*
  - To help confirm the diagnosis of urinary retention

Specialist investigations following discussion with seniors

- US KUB (kidneys, ureters and bladder)
  - Ultrasound of the urinary tract may be useful for assessing hydronephrosis and prostate size. In the case of chronic urinary retention it can be used to measure post-void residual volume.

Management

Specific scenarios

If the residual volume is <1 L, the patient is otherwise clinically well, and there is no sign of acute renal impairment on blood tests.

The initial management is the same for patients presenting in both acute and chronic urinary retention, which involves inserting a catheter for bladder decompression. This should be attempted per urethra, but if this is not possible due to an obstruction or trauma, then a suprapubic catheter may be inserted. This should only be carried out by someone adequately trained in the procedure, and it must be ensured that the patient has no contraindications, particularly prior abdominal surgery, which could lead to the adherent bowel to the abdominal wall being perforated during trocar insertion, and a history of bladder cancer as the cancer may seed outside the bladder.

Urine can then be collected for analysis as stated previously, and it is imperative that the residual volume be documented. Typically, patients presenting with acute urinary retention will have a residual volume of <1 L, whereas patients with acute-on-chronic retention will have a residual volume of >1 L.

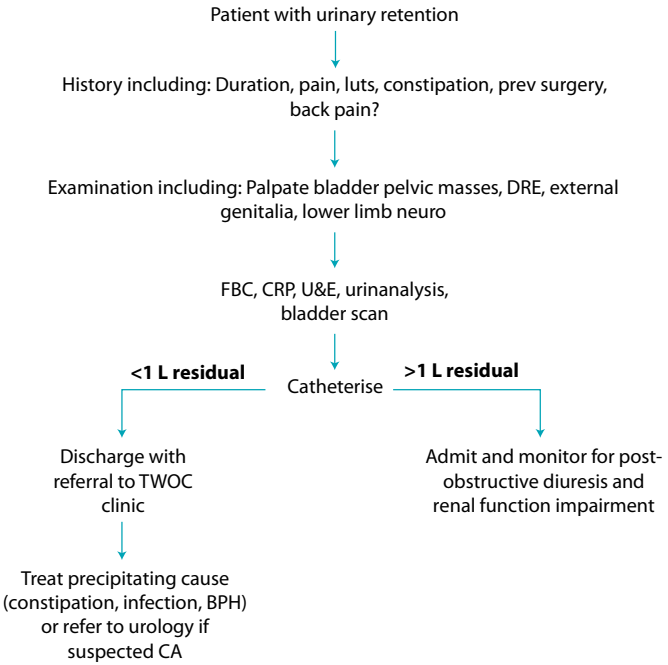
- Discharge home with catheter.
- Treat precipitating cause, which may involve antibiotics for infection, laxatives for constipation or the commencement of an α-blocker e.g. tamsulosin 400 μg OD (once daily).
- The patient should return for a trial without catheter (TWOC) after at least 1 week, although practically this is scheduled for 2–4 weeks
- If there is any suspicion of prostatic malignancy on examination, the appropriate follow-up should be arranged with a PSA (prostate-specific antigen) to be done at a later date (as this can be raised in retention and following catheterisation) – unless metastatic prostatic cancer is suspected, in which case a PSA at the time of presentation is appropriate

If the residual volume is >1 L:

- The patient may experience post-obstructive diuresis (this will almost certainly occur if there is any sign of renal impairment or hydronephrosis). This is defined as a urine output of >200 mL/hour for 2 consecutive hours, or >3 L of urine in 24 hours. It is prudent to admit a patient for 4–6 hours for monitoring. If no diuresis occurs, the patient can be discharged.

- This can be treated with replacement of around 75% of the urine output (not 100% or this will drive high urine outputs) over the previous hour with any combination of oral and intravenous fluids. Occasionally the patient may develop a prolonged pathological diuresis, in which case they should maintain strict fluid balance and monitoring of electrolytes.
- Patients can develop decompression haematuria, which is normally self-limiting after the first 48–72 hours. If severe, it may require bladder washout or occasionally insertion of a 3-way catheter for irrigation.
- Once fit for discharge, in the case of HPCR (indicated by renal impairment and upper tract dilatation on ultrasound), the patient should not undergo TWOC until a definitive procedure takes place. If the patient is not fit for surgery, they may be managed with a long-term catheter or intermittent self-catheterisation.

Summary algorithm


Patient with urinary retention
History including: Duration, pain, luts, constipation, prev surgery, back pain?
Examination including: Palpate bladder pelvic masses, DRE, external genitalia, lower limb neuro
FBC, CRP, U&E, urinanalysis, bladder scan
Catheterise
<1 L residual
>1 L residual
Discharge with referral to TWOC clinic
Treat precipitating cause (constipation, infection, BPH) or refer to urology if suspected CA
Admit and monitor for post-obstructive diuresis and renal function impairment

Key questions to ask over the phone when being referred a urinary retention case, which will make your time on-call easier:

1. Is the patient known to have BPH (benign prostatic hyperplasia)?
2. What were the findings on abdominal examination?
3. Has a catheter been inserted?
4. What was the residual volume?
5. What were the blood results? (Request they be performed if not yet done.)

Chapter 32
Testicular torsion

Amelia Davidson

Testicular torsion is a urological emergency. It is caused by twisting of the spermatic cord, which carries the blood supply to the testicle, leading to ischaemia and necrosis.

Testicular torsion has a bimodal distribution, tending to occur in the perinatal period and in adolescent boys, but it can occur at any age. The annual incidence is 1 in 4000 in males under 25 (Somani et al., 2010).

The key points to consider in suspected testicular torsion admissions are:

- Early diagnosis and management is vital to save the testis.
- Acute scrotal pain can be distressing for the patient and their parents, so take a thorough history, conduct a careful examination and communicate the treatment options at the earliest possible opportunity.
- If there is a high index of suspicion of torsion you should immediately contact your senior and book the patient for surgical exploration. A negative exploration is a better outcome than losing a potentially salvageable testis.

History and examination

Specific details to elicit are:

- How old is the patient?
- When did the pain start? Timing of onset is crucial, as salvageability is 90%–100% within 6 hours.
- Enquire about any associated symptoms – nausea and vomiting are common (60%–70% of patients).

- Enquire about any voiding symptoms such as frequency, urgency and dysuria.
- Is there a history of trauma?
- Take a full sexual history in a sexually active male.
- A previous history of similar testicular pain, which resolved spontaneously, may imply intermittent torsion.
- Any prior genitourinary surgeries or urological abnormalities, including cryptorchidism (where one or both testes are undescended).

As part of a full examination, focus on:

- Look for a red, swollen and high-riding testicle in the scrotum.
- Palpate the scrotum and its contents (testes, epididymis, cord) and compare with the unaffected hemiscrotum.
- Always examine the abdomen and inguinal canal. Pain from appendicitis or ureteric colic may radiate to the testicle.
- Is the swelling transilluminable? This may point towards a hydrocoele rather than acute torsion.
- In a neonate, examine for scrotal swelling, discolouration, and a firm painless mass in the testes (extra-vaginal torsion).
- There are no strong clinical signs in testicular torsion but you can:
  - **i.** Elicit the cremasteric reflex – an ipsilateral absent reflex may be an indicator of testicular torsion.
  - **ii.** Is pain relieved by the elevation of the scrotum above the pubic symphysis? (This is called 'Prehn's sign' and is usually negative in testicular torsion while being positive, with relief from pain, in epididymo-orchitis).

Differential diagnoses

The two main differentials to consider are torsion of the appendix testis (see Section on 'How to differentiate between testicular torsion and other differential diagnoses') and epididymitis/epididymo-orchitis. Other causes of acute scrotal pain include mumps orchitis (NB: This is a notifiable disease), varicocele, scrotal haematoma, idiopathic scrotal oedema, incarcerated hernia, appendicitis with referred pain, or systemic disease (e.g. Henoch–Schönlein purpura), which can cause testicular pain.

If there is a history of trauma, consider testicular contusion, rupture or torsion. Fat necrosis has also been reported in prepubertal overweight boys after exposure to cold.

How to differentiate between testicular torsion and other differential diagnoses

- *Acute epididymo-orchitis*: This is characterised by subacute onset of pain with voiding symptoms. In young males, remember to take a sexual history. On examination, the testis lies vertically rather than horizontally and the cremasteric reflex is usually still present. Elevating the scrotum decreases discomfort (Prehn's sign positive). A positive urine culture is found in a minority of patients with epididymo-orchitis, so always remember to send one to the laboratory. Colour Doppler ultrasound scan shows *increased* vascularity in the epididymis ± testes often with a reactive hydrocele.

- *Torsion of the hydatid of Morgagni (appendix testes)*: The appendix testis is a vestigial remnant of the Müllerian duct. The duration of symptoms tends to be shorter in testicular torsion (most present within 12 hours) compared to torsion of the appendix testes. On examination, patients with torsion of the appendage feel isolated tenderness at the superior pole of the testes. The classic sign is a 'blue dot' – the necrotic appendix seen through scrotal skin.

- *Testicular neoplasm*: Testicular cancer will usually present with a painless, unilateral, firm to hard scrotal swelling. Up to 20% of patients will present with pain, mimicking acute torsion or epdidymo-orchitis. Ultrasound is sensitive and specific for diagnosing testicular tumours.

Investigations

- Routine bloods should be ordered including:
  - *FBC (full blood count) and CRP (C-reactive protein)*: A non-specific leucocytosis is found in 30% of patients with testicular torsion. CRP will rise in the presence of inflammation or infection, but only peaks at 48 hours
  - Renal function
  - Group and save with clotting as part of a preoperative workup

- Urinalysis with microscopy, culture and sensitivity (MC&S)
  - To rule out a urinary tract infection
  - It is important to remember that urinalysis can be negative in epididymitis/epididymitis-orchitis and positive in the setting of testicular torsion.

Specialist investigations following discussion with seniors

- Ultrasound with Doppler flow

Testicular torsion is a clinical diagnosis and you shouldn't wait for an USS before organising surgery.

  - Within 6 hours the testes will look enlarged and after 24 hours the testes appear heterogeneous in echotexture, implying necrosis. Reactive hydrocoeles are common.
  - Colour Doppler imaging is used to assess the vascular integrity of the testes. Altered or absent blood flow in the testes and epididymis is the most sensitive sign. Twisting of the spermatic cord (the 'whirlpool' sign) and thickening with hyperaemia of the scrotal skin can be seen with greyscale or colour Doppler ultrasound.

Specific scenarios

A 13-year-old boy presents with intermittent severe scrotal pain since playing rugby 1 week ago. This episode began 3 hours ago and is associated with vomiting.

This history is highly suspicious of intermittent testicular torsion. The likelihood of salvaging the testes declines with time. If a patient is admitted less than 4–6 hours after the onset of their symptoms there is a much greater chance of testicular viability.

- Assess and document the state of the skin, testes, epididymis and spermatic cord
- Escalate the patient urgently to the on-call urology registrar
- Give analgesia
- Make the patient nil-by-mouth
- Prepare the patient for theatre

Surgery is the only definitive management for testicular torsion. A midline raphe incision or bilateral transverse scrotal incisions are made. If the testicle is necrotic an orchidectomy (removal of testis) is performed along with a contralateral orchidopexy (three-point fixation) to prevent future torsion of the remaining testicle. If the testis is viable (judged by a return of colour), a bilateral orchidopexy is generally performed.

In rare cases where surgery is not available within 6 hours, manual detorsion can be attempted. The affected testis is usually twisted medially,

so the 'open book' method can be employed to rotate the testicle back to its anatomical position. Immediate pain relief and blood flow on Doppler ultrasound indicate a successful detorsion.

If orchidectomy is performed, patients may need routine follow-up for fertility issues, risk of cancer and the psychological impact of losing a testicle.

- Reduced fertility, caused by anti-sperm antibodies influencing spermatogenesis, can occur after orchidectomy or orchidopexy. However, paternity rates are not usually affected. In patients who have trouble conceiving, it is likely there was a separate underlying issue.
- There is a 3.2-fold risk (Visser et al., 2003) of developing a testicular tumour in the first 15 years after torsion, so patient education on regular self-examination is advised.
- Losing a testicle can have a significant psychological impact, so insertion of a prosthesis is usually arranged 6 months after orchidectomy.

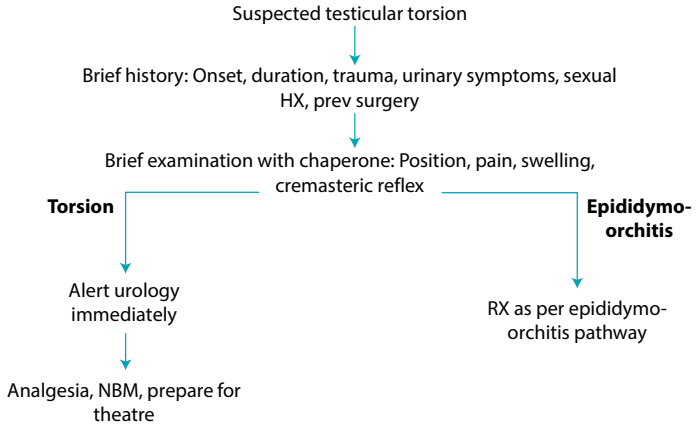
A 21-year-old man presents with a 2-day history of an acutely red and tender scrotum with associated dysuria.

The differentials here include epididymitis/epididymo-orchitis, missed testicular torsion, or a testicular tumour.

- Complete a thorough examination and document exactly where the patient is tender and what the timeframe is.
- If there is any doubt, this patient should be treated as having acute testicular torsion until proven otherwise.
- Take routine bloods (FBC [full blood count], U&E [urea and electrolytes], CRP [C-reactive protein]) and perform urinalysis. Remember to send urine for routine culture.

Acute epididymitis in men under 35 years of age is usually due to *Chlamydia trachomatis* or *Neisseria gonorrhoea* infections (over 35 it tends to be due to *Escherichia coli*).

Summary algorithm


Suspected testicular torsion
Brief history: Onset, duration, trauma, urinary symptoms, sexual HX, prev surgery
Brief examination with chaperone: Position, pain, swelling, cremasteric reflex
Torsion
Epididymo-orchitis
Alert urology immediately
Analgesia, NBM, prepare for theatre
RX as per epididymo-orchitis pathway

Key questions to ask over the phone when being referred a suspected testicular torsion, which will make your time on-call easier:

1. When did the pain start? It is critical to determine the exact time of onset as it guides management.
2. Does the patient have associated nausea and vomiting/fever/voiding symptoms?
3. What were the findings on scrotal and abdominal examination?
4. Has the patient received pain relief? It is difficult to examine a child with an acutely tender scrotum.
5. When did the patient last eat and drink?

References

Somani BK, Watson G, Townell N et al. Practice: Easily missed? Testicular torsion. *BMJ* 2010;341:c3213.

Visser AJ, Heyns CF. Testicular function after torsion of the spermatic cord. *BJU Int* 2003;92(3):200–3.

Chapter 33
Obstructive uropathy

Rohit Srinivasan

Obstructive uropathy (urinary tract obstruction) is when urine cannot flow freely within the urinary tract. It may be structural or functional in nature and lead to renal impairment. It can be caused by a lesion at any level in the urinary tract. Urinary tract obstruction occurs most commonly in the young and old. In children (usually boys), it is due to anatomic abnormalities including posterior urethral valves or stenosis at the pelviureteric junction (PUJ). In young adults, it is most commonly due to calculi. In older men, it is most commonly due to benign prostatic hyperplasia (BPH). In women, urinary tract obstruction tends to be caused by pelvic tumours, pregnancy or prolapse of pelvic structures.

The presentation of obstructive uropathy varies considerably depending on the site, degree and onset of the obstruction. These can be divided as follows:

- Acute upper tract obstruction
  - Severe flank pain that radiates to the groin
  - Loin tenderness
  - Signs and symptoms of a urinary tract infection (UTI)
  - Anuria suggests complete obstruction bilaterally
- Chronic upper tract obstruction
  - Flank pain
  - Renal impairment
- Acute lower tract obstruction
  - History of bladder outflow obstruction symptoms: frequency, urgency, hesitancy, poor urinary stream, voiding small amounts, sensation of incomplete bladder emptying
  - Severe suprapubic pain
  - Evidence of a distended bladder
  - Signs and symptoms of a UTI
  - Digital rectal examination (DRE) may reveal an enlarged prostate, tenderness or reduced anal tone

- Chronic lower tract obstruction
  - History of lower urinary tract symptoms (LUTS)
  - DRE as previously mentioned

The key points to consider in any obstructive uropathy admission are:

- To determine the site and degree of obstruction
- To differentiate acute from chronic urinary tract obstruction so that the appropriate investigations and management can be initiated

History and examination

The specific details to elicit are:

- Nature and severity of any pain
- Associated symptoms, especially those of urosepsis such as fever, rigors, dysuria, nausea and vomiting
- Any previous similar episodes? Recurrence of calculi is common and if left untreated can also lead to chronic pyelonephritis or pyonephrosis (a collection of pus in the kidney, which does not clear; this often needs drainage as otherwise infection persists)
- LUTS
  - *Storage*: Urinary frequency, urgency, nocturia, overflow incontinence
  - *Voiding*: Poor stream, dysuria, hesitancy, terminal dribbling, incomplete voiding
- Quantify the urine output as accurately as possible – absolute anuria is either due to complete obstruction or fulminant prerenal or intrinsic renal failure
- Any constitutional symptoms that may suggest malignancy
- Neurological symptoms that may suggest cauda equina syndrome if acute
- Results of any previous investigations such as USS or computerised tomography of the kidney, ureters and bladder (CT KUB) are useful to know
- Previous abdominal or pelvic surgery
- Previous history of malignancy

As part of a full examination focus on:

- Is the patient showing signs of sepsis?
- What is the degree of their pain?
- What is the hydration status of the patient?

- Is there any evidence of previous abdominal surgery or transplanted kidney?
- Is the bladder distended?
- Is there any evidence of an enlarged or tender prostate on DRE?

It is important to note cases of obstructive uropathy that will require urgent referral and management:

- *Anuria*: Suggestive of complete urinary tract obstruction
- Any urinary tract obstruction in a patient with one kidney
- Acute kidney injury (AKI)
- Severe pain that is not controlled with analgesia
- Urinary tract obstruction with signs of sepsis
- Neurological dysfunction

Routine investigations

Routine bloods should be ordered including:

- *FBC (full blood count) and CRP (C-reactive protein)*: To look for anaemia secondary to chronic kidney disease (CKD) and assess severity of any infection
- *Renal function and electrolytes*: To assess degree of any possible obstruction causing renal impairment. Also, after the relief of chronic obstruction, there may be severe Na^+/K^+ losses
- *Group and save with clotting*: To assess for coagulopathy if the patient has haematuria or is on warfarin. You may need to consider a blood transfusion if the haematuria is severe. Clotting is warranted in case surgical or radiological intervention is necessary
- *Blood cultures*: In the case of sepsis
- *Urinalysis*
  - To rule out a urinary tract obstruction
  - Blood and leucocytes are also commonly seen during urinary tract calculi
- *Ultrasound of the kidney, ureters and bladder (US KUB)*
  - It is a useful investigation to demonstrate renal parenchymal inflammation and masses, hydronephrosis, bladder distension, prostatic enlargement and renal calculi
- *CT KUB*
  - This is the gold standard imaging modality for suspected renal calculi
  - It is a non-contrast study, so can be performed in patients with poor renal function

- It may also give information about other intra-abdominal structures
- Patients should be imaged within 24 hours of presentation with either USS or CT depending on availability of resources

Specialist investigations following discussion with seniors

- Flexible cystoscopy
  - Allows direct visualisation of any abnormalities in the urinary tract. It is commonly performed in cases of haematuria as an outpatient.
- CT urogram
  - This is a contrast study that is used to visualise any suspected pathology in the entire upper urinary tract
  - Ideally should be performed when the renal function is normal
- Renal radionuclide scans
  - Radioisotopes such as MAG3 (mercaptoacetyltriglycine) and DMSA (diethylenetriaminepentacetate) are used to determine the function and perfusion of each individual kidney. They are often used in conjunction with diuresis renography in cases of hydronephrosis where there is no apparent obstruction.
- Voiding cystourethrography (VCUG)
  - Demonstrates nearly all bladder, neck, and urethral obstructions and vesicoureteral reflux
  - It is commonly performed in children to investigate congenital abnormalities
  - In adults, it may be used in suspected cases of urethral strictures

Specific scenarios follow:

An adult patient presents with acute renal colic, normal inflammatory markers and renal function. The patient is otherwise well and haemodynamically stable.

This is most likely due to a urinary tract calculus and you should confirm the diagnosis using a CT KUB.

- If stone is less than 5 mm with no evidence of hydronephrosis and the pain is well controlled, the patient can be discharged. Prescribe analgesia and a 4-week course of an α-blocker (e.g. Tamsulosin 400 μg OD once daily)
- >90% of stones <5 mm pass spontaneously within 4 weeks
- Advise maintaining a good oral fluid intake
- An outpatient clinic appointment should be arranged for 4–6 weeks' time

Indications for admission include severe pain that requires extensive analgesia, signs of sepsis, impaired renal function, evidence of larger stones (>10 mm) and hydronephrosis.

Patients with larger ureteric stones, without infection, usually require admission.

- Start IV fluids and analgesia
- Keep nil-by-mouth (NBM)
- Discuss with a senior whether the patient should be listed for retrograde insertion of a ureteric stent

Where a patient presents with acute renal colic, raised inflammatory markers, impaired renal function and signs of sepsis.

- Start IV fluid resuscitation and perform 'Sepsis Six' protocol (oxygen, IV fluids, monitoring of urine output, blood cultures, taking lactate and blood and giving IV antibiotics stat).
- Arrange urgent CT KUB to confirm diagnosis and request early senior input
- If there is evidence of infection and obstruction, urgent early drainage is required either via retrograde ureteric stent placement or nephrostomy (percutaneous drainage of the kidney by radiological placement of a drainage tube; this is often the preferred option if the patient is too unwell for general anaesthesia or if there are suggestions that retrograde stent placement may fail, e.g. a very large, impacted ureteric stone)

Further management involves treatment of the infection and subsequently, definitive treatment of the cause of the obstruction can be decided upon.

An elderly gentleman presents with acute urinary retention and normal renal function, but he is otherwise haemodynamically stable.

- Insert a urinary catheter immediately and record residual volume
- Take a full urological history and examination to establish cause
- Antibiotics should be given if there is evidence of a UTI

Further management depends on the cause of retention. For acute urinary retention secondary to prostatic enlargement, the patient can be discharged with a urinary catheter following a referral to a 'TWOC' (trial without catheter) clinic for approximately 2–3 weeks' time. It is advisable to start the patient on an α-blocker (tamsulosin 400 μg OD) prior to the removal of the catheter.

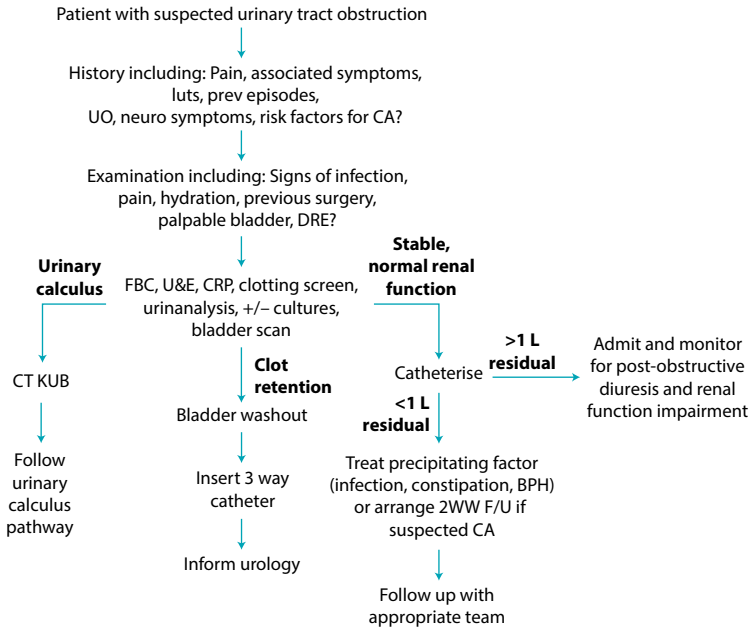
In acute urinary retention secondary to a clot in significant haematuria, it is important to insert a 3-way catheter and perform a bladder washout using a 50 mL bladder syringe. Once this has been adequately achieved, irrigation using normal saline should be commenced via the 3-way catheter. These patients will require admission for monitoring of further haematuria.

Natural sequelae

Many patients who are seen with acute urinary retention and successfully catheterised can be managed as outpatients. However, there are several important complications, which may develop and require management, such as:

- AKI
- UTI
- *Post-obstructive diuresis*: A polyuric response of the kidneys after relief from severe bladder outflow obstruction. In severe cases, this can result in marked dehydration and electrolyte imbalance

Summary algorithm


Patient with suspected urinary tract obstruction
History including: Pain, associated symptoms, luts, prev episodes, UO, neuro symptoms, risk factors for CA?
Examination including: Signs of infection, pain, hydration, previous surgery, palpable bladder, DRE?
FBC, U&E, CRP, clotting screen, urinanalysis, +/– cultures, bladder scan
Urinary calculus
CT KUB
Follow urinary calculus pathway
Clot retention
Bladder washout
Insert 3 way catheter
Inform urology
Stable, normal renal function
Catheterise
>1 L residual
Admit and monitor for post-obstructive diuresis and renal function impairment
<1 L residual
Treat precipitating factor (infection, constipation, BPH) or arrange 2WW F/U if suspected CA
Follow up with appropriate team

Key questions when taking a referral for obstructive uropathy, which will make your time on-call easier:

1. Does the patient have any pain? If so, clarify site, nature and onset.
2. What are the findings on examination including DRE?
3. What are the results of the urinalysis?
4. What are the blood results?
5. Has adequate analgesia been given?
6. Are there any signs of sepsis?

Taylor & Francis
Taylor & Francis Group
http://taylorandfrancis.com

Index

A

A&E department, *see* Accident and emergency department
AAA, *see* Abdominal aortic aneurysm
ABCDE approach, *see* Airway, breathing, circulation, disability, exposure approach
Abdominal aortic aneurysm (AAA), 7, 64, 76, 153
Abdominal compartment syndrome, 167–168
Abdominal examination, 3–5
  special tests, 5
  surgical scars, 6–8
Abdominal pain, 107, 157
Abdominal tenderness, 55
Abdominal ultrasound scan (USS), 106, 129
Abdominal X-ray (AXR), 81, 88, 97, 106, 116
ABG, *see* Arterial blood gas
Abnormal clotting function, 56
Acalculous cholecystitis, 127–128
Accident and emergency department (A&E department), 33, 92, 98, 121, 222
ACE inhibitors, *see* Angiotensin-converting-enzyme inhibitors
ACS, *see* Acute coronary syndrome
ACTH, *see* Adrenocorticotropic hormone
Activated partial thromboplastin time (aPTT), 151
Activities of daily living (ADLs), 262
Acute appendicitis, 73
  discussion with seniors, 75
  history and examination, 73–74
  investigations, 75
  natural sequelae, 77
  specific scenarios, 76–77
Acute cholangitis, 128–130
Acute cholecystitis, 107
Acute coronary syndrome (ACS), 37, 97, 106, 116
Acute diverticulitis, 35
  history and examination, 35–36
  natural sequelae, 39–40
  routine investigations, 36–37
  specialist investigations, 37–39
Acute epididymitis, 285
Acute epididymo-orchitis, 283
Acute kidney injury (AKI), 115, 190, 216, 289
Acute limb ischaemia, 147
  clinical features, 149
  history and examination, 147–149
  routine investigations, 149–150
  specialist investigations, 150
  specific scenarios, 150–152
Acute lower tract obstruction, 287
Acute mesenteric ischaemia (AMI), 95
  history and examination, 96
  investigations, 97–98
  natural sequelae, 99–100
  routine investigations, 96–97
  specific scenarios, 98–99
Acute pancreatitis, 113
  history and examination, 113–114
  natural sequelae, 122
  principles of initial management, 118–120
  routine investigations, 114–116
  specialist investigations, 117
  specific scenarios, 120–121
Acute pancreatitis, 5–6
Acute physiology and chronic health evaluation II score (APACHE II score), 108, 115
Acute respiratory distress syndrome (ARDS), 116, 190
Acute upper gastrointestinal (UGI) bleeding, 63
  history and examination, 63–64
  specific scenarios, 64–65
Acute upper tract obstruction, 287
Acute urinary retention, 275
Addisonian crisis, 141–142
Addison's disease, 141
ADLs, *see* Activities of daily living
Adrenal glands, 140
  anatomy and internal structure, 140
  pathology, 141
  specific scenarios, 143–144
Adrenaline injection, 65
Adrenal venous sampling (AVS), 142
Adrenocorticotropic hormone (ACTH), 140
Advanced life support (ALS), 61, 127

Advanced trauma life support guidelines (ATLS guidelines), 179, 198
Adynamic obstruction, 27
AF, *see* Atrial fibrillation
AIN, *see* Anal intraepithelial neoplasia
Airway, breathing, circulation, disability, exposure approach (ABCDE approach), 17, 19, 27, 45, 61, 86, 98, 113, 127, 155, 166, 175, 187, 191–192, 198, 217, 247
Airway maintenance with C-spine protection, 180–181
AKI, *see* Acute kidney injury
Alanine aminotransferase (ALT), 115, 129
Albumin, 115
Alkaline phosphatase (ALP), 105, 129
Allergies, Medications, Past medical history, Last meal–what time?, Events/environment relating to injury (AMPLE), 185
ALP, *see* Alkaline phosphatase
α-fetoprotein, 233
ALS, *see* Advanced life support
ALT, *see* Alanine aminotransferase
AMI, *see* Acute mesenteric ischaemia
Amnesia, 198
AMPLE, *see* Allergies, Medications, Past medical history, Last meal–what time?, Events/environment relating to injury
Ampulla of Vater, 125
Amylase, 105, 114, 129
Anaerobic microorganism, 213
Anal cancer, 59–60
Anal fissure, 18, 57–58
Analgesia, 152, 232
Anal intraepithelial neoplasia (AIN), 59
Anal tumour, 18
Anastomosis, 172
Anastomotic leak, 69, 171
  history and examination, 172–173
  routine investigations, 173–174
  specialist investigations, 174
  specific scenarios, 174–175
Anastomotic stricture, 69
Anastomotic ulcer, 69
Aneurysms, 153
Angina, 156
Angiodysplasia, 19
Angiotensin-converting-enzyme inhibitors (ACE inhibitors), 114
Angular stomatitis, 4
Anterograde, 198
Anti-inflammatory medication, 232
Antibiotics, 119, 121
Anticoagulation, 197
Aortic dissection, 156
  classification, 158–159
  history and examination, 156–157
  routine investigations, 157
  specialist investigations, 157–158
Aorto-enteric fistula, 19, 63
APACHE II score, *see* Acute physiology and chronic health evaluation II score
Apixaban, 197
Appendicectomy, 8
Appendicitis, 5
Appendix testes, 283
aPTT, *see* Activated partial thromboplastin time
ARDS, *see* Acute respiratory distress syndrome
Arterial blood gas (ABG), 82, 87, 115, 127, 136, 190
Arterial duplex, 150
Arterial graft thrombosis, 151
Arterial/venous blood gas, 97
Aspartate aminotransferase (AST)
Asterixis, 4
Asthma, 232
ATLS guidelines, *see* Advanced trauma life support guidelines
Atrial fibrillation (AF), 19, 56, 134
Atypical ulcer disease, 62
AVS, *see* Adrenal venous sampling
AXR, *see* Abdominal X-ray

B

Balthazar grade, 117
Band erosion, 69
Band slippage, 69
Bariatric surgery, 68
  complications of, 68
  gastric banding, 69
  roux-en-Y gastric bypass, 68–69
  sleeve gastrectomy, 70
  specific scenarios, 70–71
Benign prostatic enlargement (BPE), 261
Benign prostatic hyperplasia (BPH), 261, 287
  history and examination, 262
  natural sequelae, 264
  routine investigations, 263
  specialist investigations, 263
  specific scenarios, 264

Benign prostatic hypertrophy, 261
Berry aneurysm, *see* Intracranial aneurysms
Beta-blockers, 135
β-HCG, *see* Human chorionic gonadotropin
Biliary sepsis, 104
Biliary tree, 125
Black tarry stools, 63
Bladder
  cancer, 236
  irritation, 268
  scan, 252, 277
Blood
  cultures, 51, 105, 129, 166, 216
  glucose, 115
Blood pressure (BP), 19, 92
Boerhaave's syndrome, 19
Bone profile, 115
Bouveret's syndrome, 109
Bowel anastomotic leak, 171
Bowel obstruction, 27
  history and examination, 27–30
  routine investigations, 30–31
  specialist investigations, 31
  specific scenarios, 31–34
Bowel perforation, 85–86
  history and examination, 86–87, 91–92
  natural sequelae, 93–94
  oesophageal perforation, 91
  routine investigations, 87–89
  specialist investigations, 89–91
  specific scenarios, 92–93
BP, *see* Blood pressure
BPE, *see* Benign prostatic enlargement
BPH, *see* Benign prostatic hyperplasia
Breast cancer, 219
Breast lump assessment
  examination, 220–222
  history, 219–220
  investigations, 222
  specific scenarios follow, 222–224
Breathing and ventilation, 181–182
Broad-spectrum IV antibiotics, 52
Bulbar urethra, 249
Burns, 187, 195
  chemical, 193–194
  depth of, 188–189
  electrical, 194
  history and examination, 188–189
  immediate assessment, 187
  major burns management, 191–193
  management, 193
  minor burns management, 190–191
  referral to specialist burns centre, 193
  routine investigations for major burns patient, 189–190

C

Cervical spine-airway, breathing, circulation, disability, exposure, 180–184
Calcitonin, 133
Calculous cholecystitis, 127
Cancer
  anal, 59–60
  bladder, 236
  breast, 219
  colorectal, 19, 41–46
  perianal disease anal, 59–60
  prostate, 236, 239
Carbon monoxide (CO), 190
Carboxyhaemoglobin, 190
Carcinoembryonic antigen (CEA), 43
Cardiac arrest, 156, 194
Care of critically ill surgical patient (CCrISP), 61, 127
Catastrophic haemorrhage, 180
Catheter management, 249
  contraindications to catheter insertion/removal without senior approval, 252
  history and examination, 250–251
  procedure, 253–255
  routine investigations, 252–253
  specific scenarios, 256–257
  specific situations, 259
  suprapubic catheters, 258
  tips and tricks for managing catheters, 255–256
  types of catheter, 251
  urethral anatomy, 249–250
CBD, *see* Common bile duct
CCrISP, *see* Care of critically ill surgical patient
CDT, *see* *Clostridium difficile* toxin
CEA, *see* Carcinoembryonic antigen
Cellulitis, 214
Cerebral spinal fluid (CSF), 199
Cerebrovascular accident (CVA), 156
Cervical spine protection (C-spine protection), 180–181
Charcot's triad, 108
Chemical burns, 193–194
Chemotherapy, 46, 223; *see also* Cancer
Chest X-ray (CXR), 106, 116, 120, 136, 157
Chlamydia trachomatis, 285
Cholangitis, 105

Cholecystectomy, 128
Cholecystitis, 5, 105
Cholecystoenteric fistula, 109–110
Cholecystokinin, 125
Chronic bladder outflow obstruction, 268
Chronic kidney disease (CKD), 37, 215, 264, 289
Chronic lower tract obstruction, 288
Chronic pyelonephritis, 288
Chronic upper tract obstruction, 287
Chronic urinary retention, 275
Chvostek's sign, 134
Circulation with haemorrhage control, 182–183
CK, *see* Creatine kinase
CKD, *see* Chronic kidney disease
Closed-loop obstruction, 27
Clostridium difficile, 18
Clostridium difficile toxin (CDT), 22
Clotting, 20, 150
Coagulation, 135, 173
Coagulation screen, 115, 244
  with INR, 105
Colonoscopy, 21, 23, 37, 44
Colorectal cancer, 19, 41
  history and examination, 42–43
  red flags, 42
  specialist investigations, 44–45
  specific scenarios, 45–46
Colostomy, 10
Colour Doppler ultrasound/imaging, 283–284
Colovaginal fistula, 36
Common bile duct (CBD), 103, 125
Commonest abnormality, 56
Comprehensive abdominal examination, 3
Computerised tomography (CT), 81, 96, 114, 128, 149, 165, 183, 197, 217
  angiography, 21, 150, 155
  aortography, 157
  colonography, 44
  CT-guided drainage, 109
  intravenous urogram, 270
  neck/chest, 136
  scan, 51, 166, 184
  urogram, 290
Computerised tomography abdomen and pelvis (CTAP), 31, 37, 75, 81, 89, 97, 104, 107, 117, 131, 174
Computerised tomography of chest, abdomen and pelvis (CT CAP), 23, 44, 231, 237
Computerised tomography of kidney, ureters and bladder (CT KUB), 269, 288–289
Conn's syndrome, 142
Contralateral orchidopexy, 284
Contrast study, 174
Contusion, 206–207
Corrected calcium, 139
Courvoisier's law, 110
Cranial injuries, 207
C-reactive protein (CRP), 20, 30, 36, 50, 64, 75, 81, 87, 96, 105, 115, 129, 165, 173, 189, 216, 231, 237, 244, 252, 269, 277, 283, 285, 289
Creatine kinase (CK), 150, 194, 216
CRP, *see* C-reactive protein
CSF, *see* Cerebral spinal fluid
C-spine protection, *see* Cervical spine protection
CT, *see* Computerised tomography
CT angiogram (CT-A), 97
CTAP, *see* Computerised tomography abdomen and pelvis
CT CAP, *see* Computerised tomography of chest, abdomen and pelvis
CT KUB, *see* Computerised tomography of kidney, ureters and bladder
Cushing's syndrome, 142
CVA, *see* Cerebrovascular accident
CXR, *see* Chest X-ray
Cystic duct, 103, 125
Cystoscopy, 237

D

Dabigatran, 197
DeBakey classification system, 158–159
Decompression haematuria, 279
Defunctioning loop ileostomy, 11–12
De Quervain's thyroiditis, 134
DIC, *see* Disseminated intravascular coagulation
Diethylenetriaminepentacetate (DPTA), 290
Diffuse axonal injury, 205, 206
Digital rectal examination (DRE), 19, 30, 50, 262–263, 287
Digital subtraction angiogram, 150
1,25-Dihydroxyvitamin D3, 137
Disability: neurological status, 183–184
Disseminated intravascular coagulation (DIC), 122, 154, 216
Diverticula, 35

Diverticular disease, 18
Diverticulitis, 35
Diverticulosis, 35
DPTA, *see* Diethylenetriaminepentacetate
Double contrast barium enema, 44
DRE, *see* Digital rectal examination
DU, *see* Duodenal ulcer
Dukes classification system, 45
Dumping syndrome, 69
Duodenal perforation, 131–132
Duodenal ulcer (DU), 62
Dynamic intestinal obstruction, 28
Dynamic obstruction, 27

E

ECG, *see* Electrocardiogram
Edoxaban, 197
Ehlers–Danlos syndrome, 156
Electrical burns, 194
Electrocardiogram (ECG), 20, 37, 43, 51, 81, 89, 97, 106, 116, 139, 149–150, 185, 194, 203, 216
Electrolytes, 30
Embolic occlusions, 148, 151
Emphysematous cholecystitis, 109
End colostomy, 11
End ileostomy, 11
Endoanal ultrasound, 51
Endocrine surgery, 133
  adrenal glands, 140–144
  parathyroid gland, 136–140
  thyroid gland, 133–136
Endoscopic retrograde cholangiopancreatography (ERCP), 104, 107, 110, 114, 117, 130
Endoscopic techniques, 21
End stoma, 10
Enterobacter, 105, 129
Enterococcus, 105, 129
Epididymitis, 227
ERCP, *see* Endoscopic retrograde cholangiopancreatography
Erect chest X-ray (Erect CXR), 75, 81, 88, 97
Escherichia coli, 105, 129, 285
ESWL, *see* Extracorporeal shockwave lithotripsy
EUA, *see* Examination under anaesthesia
Examination under anaesthesia (EUA), 50
Exposure/environmental control, 184
External haemorrhoids, 54
Extracorporeal shockwave lithotripsy (ESWL), 247
Extradural haematoma, 206
Extradural haemorrhage, 205

F

Facultative anaerobic microorganism, 213
Familial adenomatous polyposis syndrome (FAP syndrome), 42
FAST scan, *see* Focussed assessment with sonography in trauma scan
Fat necrosis, 282
FBC, *see* Full blood count
FFP, *see* Fresh frozen plasma
Finasteride, 264
Fistula, 52
Fistula-in-ano, 58
Flail chest, 182
Flexible cystoscopy, 270
Flexible sigmoidoscopy, 37–38, 44
Fluid balance, 118
Focussed assessment with sonography in trauma scan (FAST scan), 154, 182
Four-dimensional computerised tomography (4D-CT), 140
Fournier's gangrene, 213
Fresh frozen plasma (FFP), 65
Full blood count (FBC), 20, 30, 36, 43, 50, 61, 75, 81, 87, 96, 105, 115, 127, 135, 149, 165, 173, 183, 189, 202, 216, 231, 237, 244, 252, 269, 277, 283, 285, 289

G

Gallbladder, 103, 125
  perforation, 128
Gallstone disease, 103
  admissions, 104
  complications, 109–110
  history and examination, 104–105
  routine investigations, 105–106
  specialist investigations, 106–107
  specific scenarios, 107–108
Gallstone ileus, 109
Gallstone pancreatitis, 108
Gamma glutamyl transferase (Gamma GT), 129
Gastric
  banding, 69
  herniation, 69
  necrosis, 69
  outflow obstruction, 28
  outlet obstruction, 109
Gastric ulcer (GU), 62
Gastrografin enema, 31

Gastrointestinal (GI)
bleeding, 17, 151
conditions, 85, 95
malignancy, 4
tract, 9
GBS, *see* Glasgow-Blatchford Score
GCS, *see* Glasgow Coma Scale
General practitioner (GP), 271
Genitourinary malignancies, 235
history and examination, 235–236
routine investigations, 237
specialist investigations, 237
specific scenarios, 238–240
Glasgow-Blatchford Score (GBS), 65–66
Glasgow Coma Scale (GCS), 4, 181, 191, 198–199
Glasgow score, 108, 115
Glossitis, 4
Glucose, 150, 165
Glyceryl trinitrate (GTN), 58
GP, *see* General practitioner
Grave's disease, 134
Group and save/cross-match, 173
Group and save with clotting, 165, 269
GTN, *see* Glyceryl trinitrate
GU, *see* Gastric ulcer
Gynaecomastia, 4

H

Haematocele, 227
Haematuria, 267
history and examination, 268–269
routine investigations, 269
specialist investigations, 270
specific scenarios, 270–272
Haemorrhage, 132, 182
Haemorrhoids, 18, 54
history and examination, 55
specific scenarios, 56–57
Haemoseal spray, 65
Haemothorax, 182
Hand-held arterial Doppler, 150
Handover, 180
Hartmann's pouch, 125
Hartmann's procedure, 39, 46
HDU, *see* High-dependency unit
Head injuries, 197
adults, 204–205
children, 204–205
cranial injuries, 207
ECG, 203
GCS, 199
history and examination, 197–199
intracranial lesions, 205–207
patients on warfarin, 205
peripheral limb neurological limb examination findings, 200
routine investigations, 202
secondary survey, 199–200
specialist investigations, 207
specific scenarios, 207–210
template for recording peripheral limb neurological exam findings, 201–202
Heart rate (HR), 19, 92
Heating probe coagulation, 65
Helicobacter pylori, 62
Henoch–Schönlein purpura, 282
Hepatic ducts, 125
Hepato-pancreato-biliary unit (HPB unit), 109, 120, 125
Hepatobiliary and pancreatic emergencies, 125; *see also* Vascular emergencies
acalculous cholecystitis, 127–128
acute cholangitis, 128–130
biliary tree, 125
gallbladder, 125
iatrogenic bile duct injury, 130–131
pancreas, 126–127
post-ERCP complications, 131–132
Hereditary non-polyposis colorectal carcinoma (HNPCC), *see* Lynch syndrome
Hernias, 79, 228
history and examination, 79–80
routine investigations, 80–81
specialist investigations, 81–83
Herpes simplex virus (HSV), 275
5-HIAA, *see* Hydroxyindoleacetic acid
High-dependency unit (HDU), 99, 156
High-pressure chronic retention (HPCR), 275
HIV, *see* Human immunodeficiency virus
HPB unit, *see* Hepato-pancreato-biliary unit
HPCR, *see* High-pressure chronic retention
HR, *see* Heart rate
HSV, *see* Herpes simplex virus
Human chorionic gonadotropin (β-HCG), 233
Human immunodeficiency virus (HIV), 215, 245
Hydrocele, 227, 233
Hydroxyindoleacetic acid (5-HIAA), 143
Hypercalcaemia, 137–138
Hyperlactataemia, 30
Hyperparathyroidism, 137

Hypertension, 156
Hypocalcaemia, 134

I

Iatrogenic bile duct injury, 130–131
IBD, *see* Inflammatory bowel disease
Ibuprofen, 232
Ileal conduit urostomy, 11
Ileostomy, 10
Immunosuppressive therapy, 215
Indwelling catheters, 251
Inferior vena cava (IVC), 4
Inflammatory bowel disease (IBD), 18, 41, 74
Inflammatory colitis, 18
Inflammatory markers, 30, 238
INR, *see* International normalized ratio
Intensive treatment unit (ITU), 39, 77, 99, 108, 121, 128, 135, 156, 175
International normalized ratio (INR), 56, 105, 115, 203
Intra-arterial streptokinase, 151
Intra-arterial thrombolysis, 151
Intracranial aneurysms, 198
Intracranial lesions, 205–207
Intraductal papilloma, 223
Intravenous urogram (IVU), 270
Iron deficiency anaemia, 18, 42
Ischaemia/necrosis, 10
Ischaemic colitis, 19
Ischiorectal abscess, 50
ITU, *see* Intensive treatment unit
IVC, *see* Inferior vena cava
IVU, *see* Intravenous urogram

J

Jaundice, 4

K

Kidney, ureter, bladder (KUB), 237, 245
Klebsiella, 105, 129
Koilonychia, 4
KUB, *see* Kidney, ureter, bladder

L

Lactate, 20, 30, 216
Lactate dehydrogenase (LDH), 115, 233, 239
Laparoscopic cholecystectomy, 8
Laparostomy, 167
Large bowel obstruction, 29–30
LDH, *see* Lactate dehydrogenase
Left iliac fossa pain (LIF pain), 18, 35
Left lower quadrant (LLQ), 5, 11
Leuconychia, 4
LFTs, *see* Liver function tests
Life-threatening pathology, 82
LIF pain, *see* Left iliac fossa pain
Limb ischaemia, 157
Limb swelling, 152
Lipase, 105, 117
Lipohypertrophy, 215
Liver function tests (LFTs), 43, 64, 92, 105, 115, 127, 129, 135
LLQ, *see* Left lower quadrant
LMN, *see* Lower motor neurone
LOC, *see* Loss of consciousness
Loop ileostomy, 11
Loop stoma, 10
Loss of consciousness (LOC), 197
Low-pressure chronic retention (LPCR), 275
Lower GI bleeding, 17
  history and examination, 17–19
  routine investigations, 20
  specialist investigations, 21
  specific scenarios, 22–25
Lower motor neurone (LMN), 200
Lower urinary tract symptoms (LUTS), 276, 288
LPCR, *see* Low-pressure chronic retention
Lund and Browder chart, 188
LUTS, *see* Lower urinary tract symptoms
Lymph nodes, 222
Lynch syndrome, 42

M

MAG3, *see* Mercaptoacetyltriglycine
Magnetic resonance (MR) angiography, 150
Magnetic resonance cholangiopancreatography (MRCP), 104, 106, 110, 117, 130
Magnetic resonance imaging (MRI), 51, 166, 207, 217
Major burns management, 191
  primary survey, 191–192
  secondary survey, 192–193
Major duodenal papilla, 125
Mallory–Weiss tear, 19

Marfan syndrome, 156
MC&S, *see* Microbiology culture and sensitivities; Microscopy, culture and sensitivity
MCV, *see* Mean corpuscular volume
MDT approach, *see* Multidisciplinary team approach
Mean corpuscular volume (MCV), 20
Membranous urethra, 249–250
Mercaptoacetyltriglycine (MAG3), 290
Mesenteric angiography, 21, 98
Meta-[^{131}I]iodobenzylguanidine (mIBG), 143
Metabolic acidosis, 30
Metabolic alkalosis, 30
Methicillin-resistant *Staphylococcus aureus* (MRSA), 167
Magnesium (Mg), 166
MI, *see* Myocardial infarction
mIBG, *see* Meta-[^{131}I]iodobenzylguanidine
Microbiology culture and sensitivities (MC&S), 166
Microdochectomy, 223
Microscopic haematuria, 244
Microscopy, culture and sensitivity (MC&S), 22, 192, 216, 232, 283
Mild pancreatitis, 120
Minor burns management, 190–191
Mirizzi's syndrome, 110
MODS, *see* Multiple organ dysfunction syndrome
MRCP, *see* Magnetic resonance cholangiopancreatography
MRI, *see* Magnetic resonance imaging
MRSA, *see* Methicillin-resistant *Staphylococcus aureus*
Multi-system, 122
Multidisciplinary team approach (MDT approach), 223, 239
Multiple organ dysfunction syndrome (MODS), 122
Myocardial infarction (MI), 148, 156

N

NAI, *see* Non-accidental injury
Naloxone, 192
Nasogastric tube (NGT), 32, 82, 89, 118, 131, 168
Nasojejunal tube (NJ tube), 118
Nasopharyngeal airway, 181
National Institute for Health and Care Excellence (NICE), 63, 203, 271
NBM, *see* Nil-by-mouth
Necrosectomy, 120
Necrotising fasciitis, 213
  history and examination, 215–216
  layers of skin, 214
  routine investigations, 216
  specialist investigations, 217
  specific scenarios, 217–218
Necrotising pancreatitis, 117
Neisseria gonorrhoea, 285
NGT, *see* Nasogastric tube
NICE, *see* National Institute for Health and Care Excellence
Nil-by-mouth (NBM), 32, 291
NJ tube, *see* Nasojejunal tube
NM, *see* Nuclear medicine
NOAC, *see* Novel oral anticoagulants
Non-accidental injury (NAI), 193
Non-contrast CT head, 206
Non-opioids, 152
Nonsteroidal anti-inflammatory drugs (NSAIDs), 86, 232, 246
Non-visible haematuria, 267
Novel oral anticoagulants (NOAC), 197
NSAIDs, *see* Nonsteroidal anti-inflammatory drugs
Nuclear medicine (NM), 237
Nutrition, 118
Nutritional disorders, 11

O

Obstructive uropathy, 287
  history and examination, 288–289
  natural sequelae, 292
  presentation, 287–288
  routine investigations, 289–290
  specialist investigations, 290–292
OCP, *see* Ova, cyst and parasite
Oesophageal trauma, 63
Oesophageal varices, 19, 63
Oesophagogastroscopy (OGD), 64
OGD, *see* Oesophagogastroscopy
Ogilvie's syndrome, 27
Open book' method, 285
Operative intervention, 57
Opsite, 167
Orchidectomy, 284–285
Orchitis, 227
Oropharyngeal airway, 181
Ova, cyst and parasite (OCP), 22

P

Pain, 62
Painless haematuria, 235

Pain, pallor, pulseless, perishingly cold, paraesthesia, paralysis of acute limb ischaemia (Six Ps of acute limb ischaemia), 148
Palliative analgesia, 152
Palliative treatment, 46
Pallor, 4
Palmar erythema, 4
Pancreas, 113, 126–127
Pancreatitis, 131
Pancreato-biliary system, 103
Paraffin gauze dressings, 193
Paraplegia, 157
Parastomal hernia, 11
Parathyroid gland, 136–137
  complications of parathyroid surgery, 137
  history and examination, 138–139
  hyperparathyroidism, 137
  routine investigations, 139
  specialist investigations, 139–140
Parathyroid hormone (PTH), 137, 139
Parkland formula, 187
Patient-controlled analgesia (PCA), 175
PCA, *see* Patient-controlled analgesia
PCC, *see* Prothrombin complex concentrate
PCNL, *see* Percutaneous nephrolithotomy
PEC, *see* Percutaneous endoscopic colostomy
Pelviureteric junction (PUJ), 287
Pemberton's sign, 134
Peptic ulcer, 19, 62–63
Percutaneous endoscopic colostomy (PEC), 33
Percutaneous nephrolithotomy (PCNL), 247
Percutaneous trans-hepatic cholangiography (PTC), 130
Perianal abscess, 49
  history and examination, 49–50
  routine investigations, 50–51
  specialist investigations, 51
  specific scenarios, 51–52
Perianal disease, 49
  anal cancer, 59–60
  anal fissure, 57–58
  fistula-in-ano, 58
  haemorrhoids, 54–57
  perianal abscess, 49–52
  pilonidal abscess, 53–54
  rectal prolapsed, 58–59
Peritonism, 30
Per rectal blood (PR blood), 55, 63, 246
Phaeochromocytoma, 143
Phosphate, 244
Photograph of wound, 166
Physiological and Operative Severity Score for enUmeration of Mortality and Morbidity score (P-POSSUM score), 175
Pilonidal abscess, 53
  history and examination, 53
  specific scenarios, 53–54
Pilonidal sinus, 53
Polycystic kidney disease, 198
Polytetrafluoroethylene (PTFE), 251
Porcelain gallbladder, 110
Post-cholecystectomy syndrome, 109
Post-ERCP complications, 131–132
Post-obstructive dieresis, 292
Post-obstructive diuresis, 278
Post-operative bleeding, 70
Post-void suprapubic bladder scan, 237
PPIs, *see* Proton-pump inhibitors
P-POSSUM score, *see* Physiological and Operative Severity Score for enUmeration of Mortality and Morbidity score
PR blood, *see* Per rectal blood
Prehn's sign, 282
Procto-sigmoidoscopy, 21
Prophylactic fasciotomies, 152
Prostate cancer, 236, 239
Prostate specific antigen (PSA), 237, 269, 278
  density, 263
Prothrombin complex concentrate (PCC), 57, 65
Proton-pump inhibitors (PPIs), 62, 89
PSA, *see* Prostate specific antigen
Pseudo-obstruction, 30
PTC, *see* Percutaneous trans-hepatic cholangiography
PTFE, *see* Polytetrafluoroethylene
PTH, *see* Parathyroid hormone
PUJ, *see* Pelviureteric junction
Pyonephrosis, 288

R

Radioisotopes, 290
Radiotherapy, 46
Ranson score, 108, 115
Recombinant tissue plasminogen activator (rtPA), 151
Rectal bleeding, 17
Rectal perforation, 93
Rectal prolapse, 58–59

Rectal tumour, 18
Recurrent laryngeal nerve (RLN), 133, 136
Renal cell carcinoma, 236
Renal function, 20, 30, 36, 51, 105, 149, 165, 173, 269, 277
Renal impairment, 277
Renal radionuclide scans, 290
Retrograde, 198
Revascularisation, 152
Reynold's pentad, 129
Rhabdomyolysis, 194
Right iliac fossa (RIF), 5, 74
Right upper quadrant pain (RUQ pain), 105, 107–108
Risk stratification, 119
Rivaroxaban, 197
RLN, *see* Recurrent laryngeal nerve
Road traffic collision (RTC), 197
Roux-en-Y gastric bypass, 68–69
RTC, *see* Road traffic collision
rtPA, *see* Recombinant tissue plasminogen activator
Rule of Nines, 188–189
3,6,9' rule, 31
Ruptured abdominal aortic aneurysm, 153–155
RUQ pain, *see* Right upper quadrant pain

S

Selenium, 166
Senior house officer (SHO), 63
Sentinel loop, 116
Serum calcium, 244
Severe pancreatitis, 121
SHO, *see* Senior house officer
Single-photon emission computed tomography (SPECT), 140
SIRS, *see* Systemic inflammatory response syndrome
Skin layers, 214
Sleeve gastrectomy, 70
Small bowel obstruction, 28, 30
Specialist registrar (SpR), 97, 272
SPECT, *see* Single-photon emission computed tomography
Sphincter of Oddi, 125
Spider naevi, 4
Spinal dermatomes, 202
SpR, *see* Specialist registrar
SSI, *see* Surgical site infection
Stanford classification system, 158–159
Staphylococcus aureus, 213
ST-elevation myocardial infarction (STEMI), 97
STEMI, *see* ST-elevation myocardial infarction
Stomas, 9, 11–13
  history and examination, 9–11
Stone analysis, 245
Stone prevention, 246
Strangulated hernias, 29
Stricture/stenosis, 11
Stroke with neurological deficit, 156
Sub-hepatic abscesses, 109
Subacute thyroiditis, *see* De Quervain's thyroiditis
Subarachnoid haemorrhage, 205, 206
Subdural haematoma, 206
Subdural haemorrhage, 205
Subsequent acute kidney injury, 194
Suprapubic catheters, 258
Surgery, 120, 284
Surgical site infection (SSI), 163
Systemic inflammatory response syndrome (SIRS), 61–62, 86, 114

T

TAAs, *see* Thoracic aortic aneurysms
Tamsulosin, 264
TB, *see* Tuberculosis
TBSA, *see* Total body surface area
Tegaderm, 167
Testicular lumps, 227
  exposure, 229
  history and examination, 229
  inspection, 229
  palpation, 230–231
  routine investigations, 231
  specialist investigations, 231–232
  specific scenarios, 232–234
  testicular torsion, 227–228
  varicocele, 228–229
Testicular malignancy, 236
Testicular neoplasm, 283
Testicular torsion, 227–228, 281
  differential diagnoses, 282
  differentiate between testicular torsion and differential diagnoses, 283
  history and examination, 281–282
  investigations, 283
  specialist investigations, 284
  specific scenarios, 284–285
Testicular tumour markers, 233
Tetanus prophylaxis, 193
TEVAR, *see* Thoracic endovascular aortic repair
TFT, *see* Thyroid function test

Thoracic aortic aneurysms (TAAs), 155–156
Thoracic endovascular aortic repair (TEVAR), 159
Thrombolysis
  angiography, 151
  contraindications to, 151
Thrombosed piles, 55
Thrombotic occlusions, 147–148, 151
Thunderclap' headache, 206
Thyroid-stimulating hormone (TSH), 133
Thyroid function test (TFT), 135–136
Thyroid gland, 133, 136
  history and examination, 133–135
  routine investigations, 135–136
Thyrotoxic crisis, 135
Thyrotoxicosis, 134
Thyroxine (T4), 133
Tissue biopsies, 21
TNM, *see* Tumour, nodes, metastases
TOE, *see* Transoesophageal echocardiography
Total body surface area (TBSA), 188
Total parenteral nutrition (TPN), 13, 118, 127, 168
TPN, *see* Total parenteral nutrition
Transient hypocalcaemia, 137
Transoesophageal echocardiography (TOE), 158
Transurethral resection of bladder tumour (TURBT), 270
Transurethral resection of prostate (TURP), 264, 272
Trauma, 179
  definitive treatment and care, 185–186
  handover, 180
  initial assessment, 180–186
  other investigations, 184–185
  resuscitation and primary survey, 180–184
  secondary survey, 185
  team preparation, 179–180
Trial without catheter (TWOC), 278, 291
Triiodothyronine (T3), 133
Trousseau's sign, 134
TSH, *see* Thyroid-stimulating hormone
Tuberculosis (TB), 58
Tumour, nodes, metastases (TNM), 44
TURBT, *see* Transurethral resection of bladder tumour
TURP, *see* Transurethral resection of prostate
TWOC, *see* Trial without catheter
Type 1 necrotising fasciitis, 213
Type 2 necrotising fasciitis, 213

U

U&E, *see* Urea and electrolytes
UC, *see* Ulcerative colitis
UGI emergency, *see* Upper gastrointestinal emergency
Ulceration, 4
Ulcerative colitis (UC), 18
Ultrasonography, 245
Ultrasound (US), 104, 128
  abdomen, 75, 117
  with Doppler flow, 284
Ultrasound of kidney, ureters and bladder (US KUB), 270, 277, 289
Ultrasound scan (USS), 81, 128, 154, 166
UMN, *see* Upper motor neurone
Unfractionated heparin, 151
Unilateral pupillary dilation, 198
Upper gastrointestinal emergency (UGI emergency), 61
  acute UGI bleeding, 63–66
  complications of bariatric surgery, 68–72
  peptic ulcer disease, 62–63
  perforation, 67
Upper motor neurone (UMN), 200
Urate, 244
Urea and electrolytes (U&E), 64, 92, 115, 127, 135, 139, 183, 203, 285
Ureteroscopy, 247
Urethral anatomy, 249–250
Urinalysis, 36–37, 116, 173, 231, 269, 277
Urinary calculus disease, 243
  history and examination, 243–244
  routine investigations, 244–245
  specialist investigations, 245
  specific scenarios, 245–248
Urinary retention, 268, 275
  history and examination, 276–277
  management, 278–279
  routine investigations, 277
  specialist investigations, 277
  specific scenarios, 278–279
Urinary tract infection (UTI), 75, 173, 287
Urinary tract obstruction, *see* Obstructive uropathy
Urosepsis, 288

Urostomy, 10
US, *see* Ultrasound
US KUB, *see* Ultrasound of kidney, ureters and bladder
USS, *see* Ultrasound scan
UTI, *see* Urinary tract infection

V

Variceal banding, 65
Varicocele, 228–229, 233
Vascular emergencies, 147
  acute limb ischaemia, 147–152
  aneurysms, 153
  aortic dissection, 156–159
  ruptured abdominal aortic aneurysm, 153–155
  TAAs, 155–156
Vascular malformations, 63
VBG, *see* Venous blood gas
VCUG, *see* Voiding cystourethrography
Venous blood gas (VBG), 20, 30, 56, 61, 75, 81, 87, 106, 127, 173, 203, 232
Venous thromboembolism prophylaxis (VTE prophylaxis), 119
Vermiform appendix, 73
Virchow's node, 4
Visible haematuria, 267
Vitamin D, 137, 139
Voiding cystourethrography (VCUG), 290
VTE prophylaxis, *see* Venous thromboembolism prophylaxis

W

Warfarin, 197
  head injuries patients on, 205
Water-soluble contrast studies, 174
WBC, *see* White blood cells
WCC, *see* White cell count
Western Diet, 41
White blood cells (WBC), 30, 36, 115
White cell count (WCC), 20, 75, 129, 216, 231, 237, 244, 252, 269
World Health Organisation (WHO), 118
  analgesic ladder, 119
Wound infections and dehiscence, 163
  abdominal compartment syndrome, 167–168
  examination, 165
  history, 163–164
  routine investigations, 165–166
  specialist investigations, 166
  specific scenarios, 166–167
Wound swab, 166

X

X-ray, 184
  AXR, 81, 88, 97, 106, 116
  CXR, 106, 116, 120, 136, 157
  erect CXR, 75, 81, 88, 97

Z

Zinc, 166
Zona fasciculata, 140
Zona glomerulosa, 140
Zona reticularis, 140